MP MASTER
MA31814

CE-4/CE-4B COMMUNICATIONS MONITOR

Cushman Electronics, Inc.

APPLICABLE TO INSTRUMENTS
WITH SERIAL NUMBERS 915
AND ABOVE

CE-4/CE-4B
COMMUNICATIONS MONITOR

INSTRUCTION MANUAL

CUSHMAN
ELECTRONICS, INC.

5601••0065••3

November 1978

CUSHMAN ELECTRONICS, INC.

MANUAL CHANGE NOTICE

INSTRUMENT CE-4/4B MANUAL NO. 5601-0065 DATE PRINTED October 1977

The following changes are necessary to bring your manual up to date. Changes are listed with the instrument serial numbers to which they apply. It is suggested that you enter these changes in your manual immediately.

Serial number 1041 and up.

Parts List, p. 6-14, Frequency Multiplier, 2200, change C55, C63, and C71 as follows:

C55, C63, C71	Cap, 15pF, 10%, 500V, P100 Cer Disc	1005-0103	RMC	CG P100

Schematic Diagram, p. 6-17/6-18, Figure 6-4, Frequency Multiplier, 2200, change the value of C55, C63, and C71 to 15 pF.

Serial number 1071 and up.

Parts List, p. 6-42, 100 Hz VCO and Phase Detector, 2800, change Q13 as follows:

Q13	Trans, 2N5089	1272-0031	Motorola	2N5089

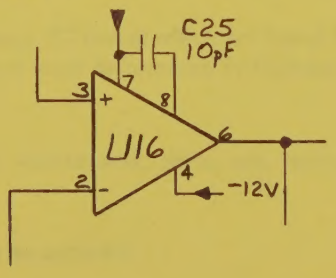
Schematic Diagram, p. 6-45/6-46, Figure 6-10, 100 Hz VCO and Phase Detector, 2800, change Q13 to 2N5089.

Serial number 915 and up.

Parts List, p. 6-133, Frequency Synthesizer and Switch Mounting M10, 4900/1100-M10, add C25 as follows:

C25	Cap, 10 pF, 10%, 100V, NPO Min Cer	1005-0074	Erie	8101-100-COGO-100K

Schematic Diagram, p. 6-137/6-138, Figure 6-30, Frequency Synthesizer, 4900-M10, add C25 as shown below:



5614-0046

Date November 1978

5603-0108

CUSHMAN INSTRUMENT WARRANTY

All instruments manufactured by Cushman Electronics, Inc. are warranteed against defects in material and workmanship for a period of one year from the date of original shipment. Cushman will repair or replace instruments, which prove to be defective, in accordance with the following policy. This policy does not apply to repair service, parts sales, nor does it apply to instruments, or parts of the instrument, which in the opinion of Cushman, have been altered or misused.

All Countries

- During the first three months after the date of original shipment, no charge for parts, replacement PC boards, labor, or freight for instruments serviced at an authorized Cushman Service Center. Free freight applies only within the customer's country. Method of transportation shall be designated by an authorized Cushman representative or Service Center.

- During the fourth through the twelfth month after the date of original shipment, no charge for parts, replacement PC boards, and labor for instruments serviced at an authorized Cushman Service Center. All transportation charges for instruments, parts, or replacement PC boards shall be paid by the customer during this period.

- Replacement PC boards during the first year are warranteed only when the defective boards have been identified by an authorized Cushman Service Center and the defective PC board is returned in accordance with Cushman's exchange board policy.

U.S.A. and Canada

In the U.S.A. and Canada an additional two year limited warranty is offered extending from the 13th until the 36th month from the date of original shipment. This warranty is effective beginning with instruments purchased on or after April 1, 1977. During this period, the following limited warranty policy applies:

- No charge for parts* used by an authorized Cushman Service Center to repair an instrument.

- Cushman will replace at no charge, PC boards which are found to be defective by an authorized Cushman Service Center. Defective boards must be returned to Cushman in accordance with Cushman's PC board exchange policy.

- All transportation charges for instruments, parts, and replacement PC boards shall be paid by the customer during this period.

* Cathode ray tubes and batteries excluded.

CUSHMAN
ELECTRONICS, INC.

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UNPACKING AND INSPECTION

When unpacking the Model CE-4 Communications Monitor inspect the packing box and the instrument for possible damage. The instrument was carefully inspected before shipment and should be ready to operate properly when received. Confirm satisfactory performance by following the procedures given in the Operating section of the Instruction Manual. If the equipment is damaged or fails to operate properly, file a claim with the transportation agency, or if insured separately, with the insurance company.

GENERAL
SECTION 1

INTRODUCTION

1.01 The Cushman CE-4 Communications Monitor measures the carrier frequency and the modulation characteristics of radio frequency signals received from radio transmitters. It also generates accurate RF signals for testing sensitivity, alignment and performance of radio receivers. It will also generate a 1 kHz tone for use in modulation tests.

1.02 In addition, a variable audio frequency tone synthesizer (M10) and a +10 dBm output level (M11) are available as separate options. When both options are installed the CE-4 becomes a CE-4B to which this manual also applies.

1.03 The signal generating system is a modern frequency synthesizer which provides high accuracy and stability and permits rapid digital frequency selection. The frequency range is from 10 kHz to 999.9999 MHz. The RF output may be either CW, FM or AM. Frequency deviation or percentage of modulation may be monitored with appropriate plug-in units.

1.04 In the Signal Generator mode the calibrated output level range is from -127 dBm to -67 dBm (.1-100μV) at the output of a 40 dB isolating pad. Approximately 100 times this level, uncalibrated, is available if the isolating pad is not used.

1.05 The frequency range covered and the RF input signal strength required for monitor operation depends on the RF plug-in used. Wideband mixer plug-ins require approximately 10 millivolts or less and operate over the frequency range of 20 MHz to 999.9999 MHz. A High Sensitivity Mixer operates over this range, but with a sensitivity down to 1μV. The Preselector plug-ins operate with approximately 20 microvolts or less and the frequency range is determined by the plug-in used. All the Preselectors, the AM Monitor and the Wattmeter/Duplexer Tester also have a wideband mixer. The High Sensitivity FM/AM/SSB Monitor has a high sensitivity mixer.

1.06 The frequency of either the received or generated signal is dialed in with seven Frequency Selector switches. The difference between the dialed in frequency and the received carrier frequency or the generated FM center frequency is read on the FREQUENCY meter. The generated frequency may be modulated, either FM or AM, by an internally generated 1 kHz tone, or by an externally generated tone from an audio oscillator or by a combination of both.

DESCRIPTION

1.07 The CE-4, with various plug-ins, forms a superheterodyne receiver. It uses plug-in units to provide maximum versatility. This makes it possible to tailor the instrument to fit a large number of applications with maximum efficiency. A plug-in unit must be in each of the two compartments when the instrument is to be operated.

1.08 Plug-ins for the purpose of measuring the frequency deviation of FM signals are used in the left hand compartment. An oscilloscope plug-in provides a visual display on a calibrated screen so that modulation characteristics may be seen in addition to the measurement of deviation. An FM Deviation Meter plug-in provides slightly higher accuracy deviation readings than the oscilloscope and in addition has an adjustable peak level indicator.

1.09 The RF plug-ins fit into the right hand compartment. Here either the Broadband Mixers, the Preselectors, the AM Monitor or High Sensitivity FM/AM/SSB Monitor or the Wattmeter/Duplexer Tester may be used to receive the RF signal. The Broadband Mixers, the AM Monitor, and the Wattmeter/Duplexer Tester cover the full bandwidth of 20 MHz-1000 MHz. The High Sensitivity Mixer and High Sensitivity FM/AM/SSB Monitor provide additional sensitivity over the full bandwidth.

1.10 The Preselectors also provide additional sensitivity, but their frequency range is limited to the land mobile radio communication bands. The Preselectors are also equipped with wideband mixers so that they may be used over the full 20-1000 MHz bandwidth, but at reduced sensitivity. Both the AM Monitor and the Wattmeter/Duplexer Tester are equipped with a wideband mixer so that they may also be used for FM measurements. Brief specifications for the plug-in units will be found in Table 1-2.

1.11 The incoming signal in the RF plug-in is mixed with a Local Oscillator (LO) from the CE-4. The LO is generated by a frequency synthesizer which is referenced to a crystal oscillator in a temperature controlled oven. The synthesized LO, based on the highly accurate crystal frequency, is the standard to which the incoming RF signal is compared. The LO is always 10 MHz above the incoming signal, therefore a 10 MHz Intermediate Frequency (IF) is produced by the plug-in. The IF, which contains all the frequency error, deviation and modulation of the original RF signal, goes to the second IF and discriminator circuits in the CE-4 where the information is removed and applied to the metering circuits. The FM signals are demodulated and reproduced in a speaker mounted in the CE-4. This FM demodulated signal is also available at the DEMOD OUTPUT connector on the front panel.

1.12 The metering circuits of the CE-4 are disabled until the received signal is strong enough for reliable measurements. A squelch voltage from the RF plug-in enables these circuits

Figure 1-1. CE-4B Communications Monitor

and turns on the SIGNAL LEVEL light on the CE-4 front panel to indicate that the metering circuits are operating.

1.13 Signal generation is accomplished by automatically removing the 10 MHz difference between the dialed in frequency and the local oscillator frequency and then using the resulting LO as the output signal. This signal now corresponds exactly to the frequency that is dialed in. The output may be CW, FM or AM according to the setting of the FUNCTION switch.

1.14 Frequency Modulation is accomplished with a voltage controlled oscillator and is introduced in one of the early mixing stages. The signal is Amplitude Modulated with a PIN diode modulator in the voltage controlled attenuator circuit.

1.15 The output level of the generated signal is adjusted in a voltage controlled attenuator which is made up of a network of PIN diode attenuators. Levels are calibrated from -127 dBm to -67 dBm (.1-100μV) at the output of the 40 dB pad (furnished with the instrument). If modification CE-4, M11 is installed, the output signal is also amplified through a Wide Band Amplifier to give a -30 to +10 dBm output signal at the High Level output connector. A fuse is mounted in the 40 dB attenuator and at the output of the Wide Band amplifier to protect the instrument circuits. The specifications for the CE-4 are listed in Table 1-1.

ACCESSORIES

1.16 Two types of accessories are available for use with the CE-4: units that plug into the Monitor and obtain operating power from it, which must be purchased separately, and items furnished with the Monitor but are not integral parts of it.

1.17 The plug-in units are the FM Deviation Meter and Oscilloscope, the RF plug-ins with their various measurement capabilities, as listed in Table 1-2, and the audio frequency synthesizer, which can be installed in the Signal Generator Modulation section of the front panel and provides thumbwheel switch selected audio frequencies in addition to the standard 1 kHz frequency. (Para. 3.14-18).

1.18 The items furnished with the Monitor but not part of it are a telescoping antenna which may be attached to the RF plug-ins, and a 40 dB pad and cable which is connected to the output when the Monitor is being used as a signal generator.

Items furnished with the CE-4

Description	CE Stock No.	Quantity
Fuse, 1/10 A	1955-0032	2
Three prong/two prong AC plug adapter	2535-0001	1
Extractor, P. C. Board*	3875-0036	1
Extender Board*	7001-0140	1
40 dB Fixed Attenuator/Adapter cable Assy	7040-0048	1
RF Cable Assembly	7037-0102	1
Antenna Assembly	2346-0007	1
Manual, CE-4	5601-0065	1
Frequency Card	5500-0004	1
Front Cover	7005-0034	1
* In circuit board compartment in bottom of instrument		

Table 1-1. Model CE-4 Specifications

ITEM	CHARACTERISTIC
RF SIGNAL GENERATION	
Frequency	
Range	.01 MHz to 999.9999 MHz
Resolution, Digital	100 Hz
Accuracy	
AM and CW Modes	± .00001% ± Time Base
FM Mode (Freq. meter 1.5 kHz scale)	± 50 Hz additional
Level (after 40 dB attenuator) into 50Ω	
Range	-127 dBm to -67 dBm (0.1μV to 100μV RMS)
Accuracy (Step attenuator +40 dB) Dial attenuator -107 dB)	
.01 MHz to 512 MHz	± 2 dB
512 MHz to 999.9999 MHz	± .5 dB additional
Dial Attenuator (Relative to -107 dB)	± 1.0 dB at dial setting of -117 and -127 (± 1 dB typical at other settings)
Step Attenuator (Relative to +40 dB)	± 2 dB
Output Impedance	50Ω nominal
MODULATION	
FM	
Internal	
Fixed Frequency	1000 Hz ± Time Base
Variable Frequency optional(M10)	10 Hz to 5000 Hz (usable to 9999 Hz) ±.005%
Resolution	
10.00 Hz to 99.99 Hz	0.01 Hz
100.0 Hz to 999.9 Hz	0.1 Hz
1000 Hz to 9999 Hz	1 Hz
Aging	20 PPM/year
External	
Frequency Range: Standard, Sine	20 Hz to 5 kHz
Optional: Sine	5 Hz to 5 kHz
Square	5 Hz to 1 kHz
Pulse	5 Hz (5% to 95% duty cycle)
Deviation Range	
Sine	0-25 kHz minimum
Square	0-2 kHz minimum
Deviation Sensitivity (Mod. Adj. full CW)	1 kHz/6mV RMS typical
(for optimum performance, the sum of the modulating frequency and deviation should be ≤45 kHz)	
Input Impedance	1 KΩ nominal
Distortion, ≤15 kHz	≤5%
Modes	
Standard	Internal; External or Internal plus External
Optional	Internal 1 kHz at 3.3 kHz ± 5% deviation plus Internal Variable at 0-25 kHz deviation plus External
AM	
Internal	
Fixed Frequency	1000 Hz ± Time Base
Variable Frequency (optional)	10.00 Hz to 9999 Hz ± .005%

Table 1-1. Model CE-4 Specifications (cont)

ITEM	CHARACTERISTIC
Resolution	
10.00 Hz to 99.99 Hz	0.01 Hz
100.0 Hz to 999.9 Hz	0.1 Hz
1000 Hz to 9999 Hz	1 Hz
Aging	20 PPM/year
External	
Frequency Range	60 Hz to 3 kHz (usable to 20 kHz)
Sensitivity	150 mV RMS for 80% Mod.
Input Impedance	1 KΩ nominal
Range	0 to 80%
Distortion	
30% Mod.	≤5%
80% Mod.	≤10%
Modes	
Standard	Internal; External; Internal plus External
Optional	Internal 1 kHz plus Internal Variable plus External
SPURIOUS OUTPUTS (after 40 dB Attenuator)	
Harmonics (Carrier Frequency 1 MHz)	-40 dB typical
Non-Harmonic Products	-35 dB maximum, -40 dB typical (≥60 Hz from Carrier) -100 dBm maximum (-130 dBm typical) at integer multiples of 100 MHz and at integer multiples of 5 MHz for output frequencies ≤30 MHz
MONITOR	
Frequency	
Range	0.05 MHz to 999.999 MHz (range determined by plug-ins)
Resolution	
Digital (dialed frequency)	100 Hz
Frequency Meter	50 Hz
Accuracy (Freq. meter on 1.5 kHz scale)	± 50 Hz ± (.00001% ± Time Base)
Sensitivity	See Plug-in specifications
Demod Output	
Level	≥3V RMS into 1 KΩ, for 25 kHz FM Deviation
Distortion	≤5%
Frequency Response	± 3 dB, 5 Hz to 5 kHz
MOD OUTPUT	
Level	0 to >3V RMS into 1 KΩ
Distortion	≤5% at 1.5V RMS
TIME BASE	
Aging	$<3 \times 10^{-9}$/Day avg. over 7 day period $<5 \times 10^{-8}$/Mo. avg. over 6 month period $<2 \times 10^{-7}$/Yr. (during first year calibrate at 6 month intervals and thereafter at 12 month intervals)
Stability	$<5 \times 10^{-8}$ 0°C to 55°C
Warmup Time	10 min. from 20°C to 1×10^{-6} (typical) <25 min. from 25°C to 1×10^{-7} <45 min. from 0°C to 1×10^{-7}
POWER REQUIREMENTS	115 or 230V AC, ± 10%, 50-400 Hz, 150W max.
DIMENSIONS	
Height	12 1/4" (31.1 cm)
Width	13" (33 cm)
Depth	18" (45.7 cm)
WEIGHT	40 lbs (18.1 kg) approx. w/o plug-ins
ENVIRONMENTAL	
Temperature, Operating	0°C to +55°C
Temperature, Storage	-40°C to +75°C

Table 1-2. Brief Plug-In Specifications

ITEM	CHARACTERISTIC	
Model 301A Oscilloscope Plug-in		
Deviation Measurement Accuracy	± 5% full scale in three ranges: ± 1.5 kHz, 5.0 kHz, 15.0 kHz	
External Inputs	Vertical and Horizontal	
External Vertical Sensitivity	5mV, 20mV, 100mV per division ± 5%	
External Frequency Response (3 dB)	100 kHz	
Model 302 Deviation Meter Plug-in		
Accuracy of Measurements	± 4% full scale in 3 ranges: 0-2.5, 0-6, 0-25 kHz	
Model 303 Broadband Mixer Plug-in		
Frequency Coverage	20-1000 MHz	
Nominal Input Impedance	50 ohms	
Bandwidth (3 dB)		
Broad	75 kHz	
Narrow	13.5 kHz	
Sensitivity: Less than	10 mV	
RF Preselector Plug-ins	Model 304B	Model 316
Frequency Coverage	25-50 MHz	140-175 MHz
Nominal Input Impedance	50 ohms	50 ohms
Bandwidth (3 dB)		
Broad	65 kHz	65 kHz
Narrow	20 kHz	20 kHz
Sensitivity: Less than	20 microvolts	20 microvolts
	Model 306E	Model 314 High Sensitivity Mixer
Frequency Coverage	450-520 MHz	20-1000 MHz
Nominal Input Impedance	50 ohms	50 ohms
Bandwidth (3 dB)		
Broad	65 kHz	75 kHz
Narrow	20 kHz	22 kHz
Sensitivity: Less than	20 microvolts	1 microvolt
Model 317 High Sensitivity FM/AM/SSB Monitor		
Frequency Coverage	50 kHz to 1000 MHz	
Nominal Input Impedance	50 ohms	
Bandwidth (3 dB)		
Broad	150 kHz typical	
Narrow	22 kHz typical	
Sensitivity		
<1 MV 2 MHz - 520 MHz	2μV typical	
<1 MV 50 kHz - 2 MHz, 520 MHz - 1 GHz	10μV typical	
≥1 MV	1 mV to 500 mV typical	
Model 311 Oscilloscope Plug-in		
Deviation Measurement Accuracy	± 5% full scale in three ranges: ± 1.5 kHz, ± 5.0 kHz, ± 15 kHz	
External Inputs	Vertical and Horizontal	
External Vertical Sensitivity	5mV, 20 mV, 100mV/Div. ± 5%	
External Horizontal Sensitivity	50mV/Div nonimal	
External Frequency Response Vertical	5 Hz to 100 kHz min.	
External Frequency Response Horizontal	20 Hz to 100 kHz min.	

Table 1-2. Brief Plug-In Specifications (cont.)

ITEM	CHARACTERISTIC
Model 313 AM Monitor	
Frequency Coverage	20-1000 MHz
AM Modulation (Meter) Range	0-100%
Nominal Input Impedance	50 ohms
Bandwidth (3 dB)	
Broad	100 kHz
Narrow	22 kHz
Sensitivity	
50-950 MHz	10mV
950-1000 MHz	20mV
20-50 MHz with CE-5, CE-6	10mV
20-50 MHz with CE-3, CE-7	50mV
Model 330 Wattmeter/Duplexer Tester	
Frequency Coverage	20-1000 MHz
Power Range	1-25 watts
Accuracy	± 4% reading plus 1% full scale
Broadband Section	
Frequency Coverage	20-1000 MHz
Nominal Input Impedance	50 ohms
Bandwidth	
Broad	100 kHz
Narrow	22 kHz
Sensitivity: Less than	10mV

SECTION 2
INSTALLATION

ENVIRONMENTAL REQUIREMENTS

Temperature

2.01 The CE-4 is designed to operate between 0°C and +55°C (ambient). In the field these temperatures can easily be exceeded if proper precautions are not taken. For instance, the internal temperature of a closed automobile trunk may exceed 65°C during summer daylight hours. Also, care should be taken not to block the cabinet's ventilating ports. Exceeding the upper or lower temperature limits for extended periods may not result in noticeable damage to the instrument, but may cause poor performance or actual malfunctioning.

RF Fields

2.02 Where extremely high RF radiation fields exist (such as when the CE-4 is used near a transmitter) the telescoping antenna should be pushed together to reduce pickup. Where many high-power transmitters are in use adjacent-channel interference may be experienced if the transmitters are operating within 90 kHz of each other. In such cases the SELECTIVITY switch on the Broadband mixers should be placed in the SHARP position. If satisfactory measurements still cannot be made, direct connection between the transmitter to be monitored and the CE-4, through a suitable RF attenuator, may be required. Contact Cushman Electronics Customer Service Department for further information.

NOTE

In the SHARP position the bandwidth is narrowed so that Deviation readings may be degraded unless the sum of the modulation frequency plus the frequency deviation is less than 11 kHz.

POWER REQUIREMENTS

2.03 The CE-4 may be operated from a 115V AC ± 10% or a 230V AC ± 10%, 50 to 400 Hz AC source. Power consumption is 150 watts.

WARMUP REQUIREMENTS

2.04 The accuracy of the CE-4 measurements depend on maintaining the master oscillator crystal at a constant temperature. This is done in the CE-4 by a thermostatically controlled oven which requires a warm-up period prior to use. See warm-up time under TIME BASE in the Specifications, Table 1-1. If the instrument has been stored at a temperature below 0°C (32°F), additional warm-up time may be required. Oven operation is independent of the ON-OFF power control switch. It is recommended that the instrument be installed so that it may be kept connected to the power source. If this is done, the CE-4 will be ready to make precise measurements within seconds after it is turned on.

SERVICE OR REPAIR

2.05 In the event that factory service or repair is required, contact the Cushman Electronics Customer Service Department for further service information or to make arrangements for shipment to the factory or to a Service Center. The factory address is:

Cushman Electronics, Inc.
Customer Service Department
2450 N. First St.
San Jose , California 95131
Telephone: (408) 263-8100

2.06 Cushman Electronics repair service is also available at the following service centers:

Anderson Associates
204 Bedford Euless Road
Hurst, Texas 76053
Telephone: (817) 268-2327

B.C.S. Associates, Inc.
940 North Fern Creek Avenue
Orlando, Florida 32803
Telephone: (305) 896-4881

B.C.S. Associates, Inc.
1310 Beaman Place
Greensboro, North Carolina 27408
Telephone: (919) 273-1918

Ossman Instruments Service Corp.
6666 Old Collamer Road
East Syracuse, New York 13057
Telephone: (315) 437-7245

Reshal Associates, Inc.
219 West University Drive
Arlington Heights, Illinois 60004
Telephone: (312) 398-7660

Tele-Radio
301 Supertest Road
Downsview P.O.
Toronto, Ontario, Canada, M3J2M4
Telephone: (416) 661-3221

PREPARATION FOR SHIPMENT

2.07 It is recommended that the shipping box and foam packaging be kept in case it becomes necessary to ship the instrument to the

service point or factory for service or repair. (Contact Cushman Electronics Customer Service Department before returning an instrument).

2.08 The following is a general guide for repackaging the instrument for shipment.

NOTE

If the instrument is to be shipped, attach a tag to the instrument identifying the owner and indicate the service or repair to be accomplished. Include the model number and full serial number of the instrument. In any correspondence, always identify the instrument by model number and serial number.

2.09 If the original container is to be used, proceed as follows:

a. Place the instrument in the original container. (If the original container is not available, one can be purchased from Cushman Electronics.)

b. Make sure that the container is well sealed with strong tape.

2.10 If the original container is not used, proceed as follows:

a. Wrap the instrument in plastic or heavy paper before placing in an inner container.

b. Place packing material around all sides of the instrument.

c. Place the instrument and inner container in a heavy carton or wooden box and seal with strong tape or metal bands.

d. Mark the shipping container: "DELICATE ELECTRONIC INSTRUMENT", "FRAGILE".

SECTION 3
OPERATION

GENERAL

3.01 Before the CE-4 is operated a suitable plug-in unit should be installed in each of the compartments (they may be omitted for CW/AM SIG GEN use only). See Table 1-2 for a list of plug-in units that may be used in the CE-4, with some of their more important characteristics. An FM Deviation Meter or an Oscilloscope is used in the left hand compartment. In the right hand compartment one of the Preselectors, Wideband Mixers or Monitors may be used.

CAUTION

Turn power off before removing or replacing plug-ins. Wait 30 seconds before removing oscilloscope.

3.02 In the Monitor function the input signal is connected to the ANT connector on the plug-in and the carrier frequency of the signal is dialed up on the CE-4 Frequency Selector switches. The carrier frequency error will then be displayed on the FREQUENCY meter and the frequency deviation will be displayed on the FM Deviation Meter or on the oscilloscope. For AM the percentage modulation will be displayed on the oscilloscope, or on the AM Monitor meter. Both FM and AM are demodulated and reproduced by a speaker, either in the plug-in or in the CE-4.

3.03 In the SIG GEN function the dialed in frequency is available at the 0-1000 MHz output connector. The type of output, FM, AM, CW is determined by the setting of the FUNCTION switch. Modulation may be either internal 1 kHz (10-9999 Hz with Variable Frequency option) or external, within the frequency range of 20 Hz - 20 kHz, or both internal and external simultaneously. RF output is calibrated from -127 dBm to -67 dBm (0.1 to 100μV RMS) at the output of the 40 dB pad when connected to the 0-1000 MHz output. Approximately one hundred times the calibrated output is available at the 0-1000 MHz connector when the 40 dB pad is not used, but attenuator calibration will not apply. The -dB settings are relative to full scale of the Variable Attenuator for any setting of the step attenuator.

FRONT PANEL CONTROLS

3.04 The front panel controls, indicators and connectors seen in Figure 1-1 are listed in Table 3-1. The seven knobs just below the MHz display windows are used to dial in a frequency. They are referred to in the text as Frequency Selectors. Operating controls for the plug-ins are described in the instruction manuals for those units.

TURN ON AND WARM UP

3.05 Plug the power cord into a 115V (230V) ± 10% 50-400 Hz source receptacle and turn on the power to the instrument with the switch on the VOLUME control.

3.06 Allow the instrument to warm up for approximately 25 minutes. This is to allow the crystal oven to come up to temperature. If the instrument has been stored at temperatures below 32°F (0°C) additional warmup time will be required. The crystal oven is on whenever the power cord is connected to an AC source. If the instrument is left plugged in with the power switch OFF, the oven will be maintained at operating temperature, and the instrument will be ready for use a few seconds after the power switch is turned on.

FREQUENCY DEVIATION MEASUREMENT

3.07 In the following procedure it is assumed that the RF plug-in is either a Model 303 Broadband Mixer or one of the Preselectors or Monitors operating in the broadband mode. In the Preselector mode the procedure is the same except that the Preselector dial must be set to the frequency dialed in by the Frequency Selector switches on the Monitor. The Model 302 Deviation Meter must be plugged into the left hand compartment of the Monitor.

3.08 Make the following connections and control settings:

a. Turn instrument on and allow time for warmup, paragraphs 3.05 and 3.06.

b. Connect an external antenna, or the telescoping antenna supplied with the instrument, to the ANT connector on the RF plug-in unit. If the telescoping antenna is used, extend it to its full length for HF measurements, to approximately 18 inches for VHF, and minimum length for UHF measurements.

c. Turn the FUNCTION switch to CAL and adjust the inner knob (on FUNCTION switch) for zero (mid-scale) reading on the FREQUENCY meter.

d. If a Model 301A Oscilloscope is being used, set Vertical and Horizontal switches to the INT position and adjust VERT POS control so that the trace is on the zero reference line while the Deviation range switch is in the ± 1.5 kHz position. Adjust the INTENSITY and FOCUS control for a sharp clear trace on the screen.

e. Change the FUNCTION switch to the

Table 3-1. Model CE-4 Controls, Indicators and Connectors

Control, Indicator or Connector	Function
FREQUENCY Meter	Indicates received or generated signal error above or below the dialed in frequency.
kHz 1.5, 5, 15	Range switch for FREQUENCY meter. Indicates full scale ranges in MONITOR and in SIG GEN FM modes. In CAL the range is ± 1.5 kHz only.
SIGNAL LEVEL Indicator Light	Lights when a received signal is strong enough for reliable measurements in MONITOR function only. Meter circuits disabled when not lighted. It is lighted but has no signal level significance in other FUNCTION switch positions.
FUNCTION CAL	The FREQUENCY meter is zeroed with the inner knob of the FUNCTION switch. FREQUENCY meter range is automatically set at ± 1.5 kHz.
MONITOR	Receive-Monitor operation. Both carrier frequency and FM deviation of the received signal may be measured. With the Model 313 and 317 plug-ins the AM percentage of modulation may be measured.
SIG GEN FM AM CW	Signal Generator operation. The output frequency is the same as the dialed in frequency. Type of signal generated depends on setting of FUNCTION switch. Modulation or deviation measured by plug-ins.
OVEN ON Indicator Light	On after oven warms up, when connected to AC power.
UNLOCKED Indicator Light	When lit, indicates an unlocked condition in the Frequency Synthesizer.
MHz Frequency Selector Switches	Each frequency selector knob is associated with a number indicating the dialed in frequency in MHz with reference to the fixed decimal point.
MONITOR DEMOD OUT Connector	Demodulated output of FM signals.
VOLUME/PWR OFF	Counterclockwise turns off AC power, except to oven. Clockwise turns on AC power and controls audio level to internal speaker.
SIGNAL GENERATOR MODULATION 1 kHz ON OFF (Standard) MOD ADJ Control	Turns on or off internal modulation. Adjusts AM percentage of modulation or FM frequency deviation according to setting of FUNCTION switch.
FM CAL Control	Adjusts center frequency of generated signal when in the FM mode according to reading on FREQUENCY meter. Center frequency may be offset up to ± 15 kHz if desired.
MOD INPUT Connector	Input for external tone modulation. Signal modulated whenever tone applied to this input. Both internal and external modulation may be used at the same time if desired.

Table 3-1. Model CE-4 Controls, Indicators and Connectors (cont'd)

Control, Indicator or Connector	Function
MOD OUTPUT Connector	Buffered output of modulation used, internal or external.
SIGNAL GENERATOR LEVEL 0 dB (x1), +20 dB (x10), +40 dB (x100)	Step attenuator. Selects dB level to be added to the outer scale on variable attenuator.
-127 to -107 dB (.1-1μV)	Variable attenuator. Selects dB level to be added to setting of step attenuator.
OFF	Switch on variable attenuator. Reduces output to negligible level when step attenuator is on 0 dB position. Remainder of instrument circuits remain on.
0-1000 MHz w/40 dB Pad	Signal Generator output. 40 dB pad must be connected for attenuator calibration to apply. Calibrated for dB setting of step and variable attenuator.

MONITOR position and dial in the assigned frequency of the transmitter with the seven Frequency Selector dials.

f. Key the transmitter. The SIGNAL LEVEL light should come on. If it does not, move the Monitor closer to the transmitter, or vice versa, until the received signal is strong enough to turn on the light. Measurements can usually be made when the Monitor is between 25 and 50 feet from the radiating antenna. When a Preselector or High Sensitivity wideband plug-in is used, measurements can be made many miles from the transmitter provided an adequate antenna is used.

g. The FREQUENCY meter reading is the difference between the assigned frequency (dialed in) and the actual transmitter radiated frequency. Select the lowest meter range that will give an on-scale reading.

h. Modulate the transmitter and read the FM deviation on the FM Deviation Meter or on the Oscilloscope. Select the appropriate Meter or Oscilloscope range. On the oscilloscope screen peaks appear above and below the horizontal center line of the display. The Deviation Meter indicates either positive or negative peaks depending on the setting of the FM DEVIATION PEAKS switch. If the DEVIATION PEAKS indicator level on the Deviation Meter plug-in has been set, all modulation peaks that exceed this level will cause the indicator to light. Refer to paragraph 2.02 for use of the SHARP-WIDE switch on the RF plug-in unit in the presence of strong RF fields.

i. Adjust the VOLUME control for the desired level output of the demodulated FM through the speaker. The demodulated output is also available at the DEMOD OUTPUT connector.

AM MEASUREMENT

3.09 Plug the Model 313 AM Monitor into the right hand compartment and follow the procedure of paragraph 3.08 a-c and e-g. AM modulate the transmitter and read the percentage of modulation on the Model 313 meter. The demodulated audio output may be monitored with the speaker in the M313 plug-in (adjust SPEAKER volume control) or at the DEMOD OUTPUT connector on the front panel of the CE-4.

3.10 To measure AM with a 317 plug-in, use a 301A or 311 Oscilloscope in the left hand compartment. Connect the 317 AM/SSB AUDIO OUTPUT to the input of the 301A or 311 using a BNC connector coaxial cable. Set the oscilloscope input sensitivity to 100mV/DIV. The percentage of modulation is 10mV P-P/% AM and will indicate 100% AM full scale. SSB measurements are made the same as AM, except percentage of modulation may not be determined, only the wave shape observed on the oscilloscope; also the CLARIFICATION control must be adjusted to maximum intelligibility when monitoring the Audio output.

SIGNAL GENERATOR OPERATION

CW Output

3.11 Make the following connections and control settings:

a. Turn on the CE-4, refer to paragraphs 3.05 and 3.06.

b. Set the FUNCTION switch to SIG GEN CW and set the seven Frequency Selector dials to the desired output frequency.

c. Turn the Internal Frequency Generator switch to OFF. Make certain that no external signal is connected to the MOD INPUT connector.

d. Set the SIGNAL GENERATOR step attenuator switch and variable attenuator control for the desired output level. Connect the 40 dB pad to the 0-1000 MHz connector and connect the other end of the pad cable to the instrument to be tested. (The output level calibration does not apply unless the 40 dB pad is used).

CAUTION

Whenever a direct connection is made between the CE-4 and a transceiver, keying the transceiver will damage the 40 dB fixed attenuator and possibly the CE-4. A fuse is mounted in the 40 dB attenuator as a protective measure. DC connected to the Monitor output without the 40 dB pad may damage the RF switch board and with the 40 dB pad may blow the fuse in the pad.

FM Output

3.12 Make the following connections and control settings:

a. Turn on the CE-4, refer to paragraphs 3.05 and 3.06.

b. Set the FUNCTION switch to SIG GEN FM and set the seven Frequency Selector dials to the desired frequency. (When the FUNCTION switch is set to SIG GEN FM the FREQUENCY meter will peg. Allow 10-15 seconds to permit the meter to come on scale before making the adjustment in paragraph c. If the meter remains pegged the FM CAL control should be readjusted to bring it back on scale).

c. Adjust the SIGNAL GENERATOR MODULATION FM CAL control for a zero reading on the FREQUENCY meter. This adjustment sets the FM center frequency to the same frequency that is dialed in on the Frequency Selector switches. Set Meter switch to 1.5 kHz for maximum resolution. The center frequency may be offset ± 15 kHz for test purposes if required.

d. Set the 1 kHz internal modulation switch to ON or OFF as desired. For external modulation connect the external source (20 Hz to 20 kHz) to the MOD INPUT connector. The external source may be a single tone or several tones summed together. Both internal and external modulation may be used simultaneously if desired.

e. Use the SIGNAL GENERATOR MOD ADJ control to set the frequency deviation. Deviation may be read on the Model 301A oscilloscope or the Model 302 Frequency Deviation plug-in. The modulation signal applied to the modulator may be monitored at the MOD OUTPUT connector.

f. Set the SIGNAL GENERATOR step and variable attenuator controls for the desired output level and connect the instrument to be tested to the output of the 40 dB attenuator. Observe CAUTION note of paragraph 3.11 d.

AM Output

3.13 Make the following connections and control settings:

a. Install a Model 313 AM Monitor in the right hand compartment of the CE-4.

b. Turn on the CE-4, refer to paragraphs 3.05 and 3.06.

c. Set the FUNCTION switch to SIG GEN AM and set the seven Frequency Selector dials to the desired frequency.

d. Set the 1 kHz internal modulation switch to ON, or set to OFF if external modulation is to be used. For external modulation connect the external source (20 Hz to 20 kHz) to the MOD INPUT connector. The external source may be a single tone or several tones summed together. Both internal and external modulation may be used simultaneously if desired.

e. Adjust the SIGNAL GENERATOR MOD ADJ control for the percentage of modulation. Read percentage on Model 313 meter. The modulation signal applied to the modulator may be monitored at the MOD OUTPUT connector.

f. Set the SIGNAL GENERATOR LEVEL attenuator controls for the desired output level and connect the instrument to be tested to the output of the 40 dB attenuator. Observe CAUTION note of paragraph 3.11 d.

VARIABLE FREQUENCY TONE GENERATOR

Description

3.14 The Variable Tone Generator is a frequency synthesizer, digital switch-controlled unit for the purpose of testing the audio signalling portions of radio receivers and for all audio frequency applications within the range of the instrument. The Tone Generator covers a range of 10.00 Hz to 9999 Hz in three ranges selected by a front panel range switch and four thumbwheel switches. Tone accuracy is ± 0.005%, the waveshape is sinusoidal and distortion is less than 1%. Tone output is either continuous or a tone burst which may be set for a duration of from .03 to 1 second.

Controls

3.15 The following controls are used to operate the instrument:

FREQUENCY (Hz) A four digit thumbwheel switch that sets the basic frequency.

X1.0, X0.1, X.01 A three-position lever switch that selects the multiplier of the basic frequency to set the frequency range.

GEN, OFF, GEN + 1 kHz A three-position Function switch that selects Tone Generator output only, Tone Generator Off, or Tone Generator plus a fixed 1 kHz signal having a fixed 3.3 kHz deviation.

BURST (SEC) A variable control that sets tone burst time in seconds. In the CONT (detent) position the tone is continuous.

ENABLE A push button that triggers one tone burst.

Operation

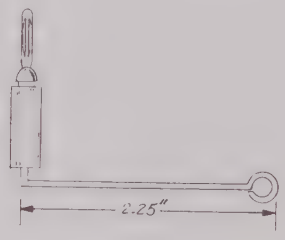
3.16 Set the FREQUENCY (Hz) thumbwheel switch to four figures representing the desired audio frequency. Set the multiplier switch (X1.0, X0.1, X.01) to place the decimal point in the four-figure setting. For example: set thumbwheel switches to 4567. Set multiplier switch to X.01. The modulating frequency will be 45.67 Hz.

3.17 Set BURST CW into the detent position. Set the Function switch to GEN, if only the frequency of the Tone Generator is desired for modulation. Set the Function switch to GEN + 1 kHz if the Tone Generator frequency and the 1 kHz internal frequency having a fixed 3.3 kHz fixed deviation are desired simultaneously for modulation. If no modulation is desired set the Function switch to OFF.

3.18 If tone bursts are desired set up as above but set BURST (SEC) control for the length of tone burst as indicated on the BURST dial. Maximum burst length is 1 second. Other settings indicate fractions of a second. Press the ENABLE push button switch. A tone burst of the length to which the BURST control is set will be delivered every time the ENABLE push button is depressed.

OPERATION NOTE

3.19 An 800 MHz antenna which will plug into the ANT connector of the plug-in may be made from a banana jack (GC Electronics # 33-002) and a 3 inch length of #12 tinned wire. Assemble according to the following illustration:



SECTION 4
THEORY OF OPERATION

INTRODUCTION

4.01 The Theory of Operation section is divided into three sub-sections. The first is a description of the Circuit Reference Series which is used for circuit and component identification. The second describes the overall functioning of the instrument from a block diagram viewpoint. The third is a description of the operation of the circuits as mounted on the circuit boards.

CIRCUIT REFERENCE SERIES

4.02 The Circuit Reference Series is a series of numbers assigned to the circuits of the instrument to make it possible to relate the actual circuit board or assembly to the schematic diagrams, the parts lists and the text of the manual with a minimum of effort.

4.03 The series of numbers assigned to the CE-4 are as follows:

1000 - Front Panel

2000 - Main Chassis, Left Side

3000 - Microwave Casting

4000 - Main Chassis, Right Side

5000 - Rear Panel

Right and left sides refer to the instrument viewed from the front in an upright position. Board circuits of the 2000 and 4000 series are mounted in the main chassis. The 3000 series are mounted in the microwave casting, with the exception of board circuit 3100, which is mounted in the main chassis. The microwave casting covers are labeled with the circuit board locations. The main chassis circuit board locations are marked on the bottom cover.

4.04 Under each main grouping the circuits are further divided into 100-number groups, and in two cases into 50-number groups (3450, 3750). These groups represent circuit boards, most of them plug-in boards. On each circuit board the components are individually numbered in a series starting with 1, each type of component having a separate series as designated by a letter or letters. The complete reference to any component includes the circuit reference number, the individual component number and the letter type indicator. For example, the first resistor, R1, in the 2100 circuit will be R2101, the second transistor, Q2, will be Q2102, etc.

4.05 When the individual circuits are described in the Circuit Description the component references will be abbreviated for convenience. Thus, R1 will refer to the first resistor on the board under consideration only. If reference is made to a component outside that board or when more than one circuit is being described the full reference designation will be used.

4.06 In order to identify each board a cross reference table is given at the beginning of Section 6 listing the basic board numbers in sequence. These numbers are etched on each board. Also listed are the board title, assembly number, circuit reference number and the figure and page number of the schematic diagram. The basic board number is the 1780-xxxx series. In cases where the board is too small for the complete number only the last four digits are used. The basic number, along with the assembly number and the circuit reference number, also appears in the parts list for each board.

FUNCTIONAL DESCRIPTION

4.07 The CE-4 Communications Monitor functions on the principle of a superheterodyne receiver. The RF front end consists of various plug-in units. A frequency synthesizer generates a Local Oscillator (LO) signal that is both stable and accurate. The Intermediate Frequency (IF) generated in the RF plug-in is 10 MHz and mixing always takes place on the high side (the LO is 10 MHz higher in frequency than the received signal).

4.08 In the Signal Generating mode the Frequency Synthesizer-generated signal that was used as the LO is shifted down by 10 MHz and used as the signal output. This automatically takes place whenever the FUNCTION switch is placed in any of the SIG GEN positions.

4.09 All the fixed frequencies, including the internal modulation frequency, are derived from a very stable Ovenized Crystal Oscillator Time Base. The fixed frequencies are phase locked to a frequency derived from this oscillator so that high accuracy and stability are maintained in the generated LO and in the output frequency. Refer to overall block diagram Figure 4-2, 4-3.

4.10 The received signal is brought into the Monitor through an RF plug-in. This may be a Broadband Mixer or an RF tuned Preselector. In either case the input frequency is mixed with the LO to generate a 10 MHz IF as the output of the plug-in. In the Monitor the 10 MHz IF is mixed with a 9.9 MHz fixed LO to generate a 100 kHz second IF. Since both LO signals are standards generated by the synthesizer, the frequency error, if any, will appear on the second IF signal. Frequency error detector circuits display this error on the FREQUENCY meter which is calibrated directly in kHz.

4.11 The modulation (FM) is recovered and the deviation measured either with the Oscilloscope or Deviation Meter plug-in. The audio modulation is displayed on the Oscilloscope and reproduced in the speaker.

4.12 In the Signal Generator mode the output may be modulated (FM or AM) by an internally generated 1 kHz modulation frequency or by an external signal (60 Hz to 20 kHz) or both internal and external modulation may be used simultaneously.

Frequency Synthesizer

4.13 The circuits of the Frequency Synthesizer make up the major portion of the instrument. Frequency generation starts with the Time Base which provides two 5 MHz outputs. One is a logic level signal to the Reference Divider, 2700, and the other is a sine wave which goes to the Frequency Multiplier, 2200. Refer to Mainframe Block Diagram, Figure 4-2.

4.14 The four least significant digits, 100 kHz, 10 kHz, 1 kHz, 100 Hz of the frequency selector switches control a 20-21 MHz Voltage Controlled Oscillator (VCO) in a phase locked loop which varies the frequency in 100 Hz steps from 20 MHz to 20.9999 MHz. This is accomplished by the circuits 100 Hz÷N, 2600, and the VCO and Phase Detector, 2800. Since a X10 multiplication of the signal takes place later on, this oscillator output is divided by 10 to make the circuit output 2-2.09999 MHz. See Overall Block Diagram, Figure 4-2.

4.15 The 2-2.09999 MHz frequency is mixed with either 20 MHz or 21 MHz in the 17.9-19 MHz mixer, 2400, to produce 17.90001-18 MHz or 18.90001-19 MHz. 21 MHz is used in the Signal Generator mode and 20 MHz in the Receive Monitor mode. This 1 MHz difference is changed to 10 MHz in the X10 multiplier later on to provide the 10 MHz difference required between the Signal Generator output and the Receive Monitor LO.

4.16 The 20 MHz for mixing is obtained from the Frequency Multiplier circuit, 2200. To obtain the 21 MHz, a 10 MHz output from the Reference Divider, 2700, through the 10 MHz modulator, 4400, is brought to the 17.9-19 MHz mixer, 2400, divided by 10 and mixed with the 20 MHz signal to produce the required 21 MHz.

4.17 Output from the 17.9-19 MHz mixer is connected to the RF mixer, 2100, where it is mixed with a fixed frequency of 125 MHz obtained from the Frequency Multiplier, 2200. Output from this mixer is 143.9-144 MHz (Sig Gen) or 142.9-143 MHz (Rec Mon). This output is connected to the 119-130 MHz mixer where it is mixed with 14-23.9 MHz from the VCO phase lock loop controlled by the 10 MHz and 1 MHz digits of the Frequency Selector switch. Output from this mixer is either 120-130 MHz (Sig Gen) or 119-129 (Rec Mon).

4.18 The 14-23.9 MHz frequency generator is made up of two circuits: 100 kHz VCO and Phase Detector, 2500, and 100 kHz÷N, 2300. This phase locked loop which is controlled by the 10 MHz and 1 MHz digit switches and is referenced to the 100 kHz output of the Reference Divider, 2700, generates a frequency variable in 100 kHz and 1 MHz steps. Because of the later X10 multiplication these steps become 1 MHz and 10 MHz in the monitor output.

4.19 The output of the 119-130 MHz mixer goes to the 1190-1300 Phase Lock Loop, 3750, and Oscillator, 3700, in the Microwave Casting where it serves as the Reference frequency. The Microwave Oscillator is locked to the 10th harmonic of this Reference frequency.

4.20 The output of the Microwave Oscillator is connected to the voltage controlled attenuator (VCA), 3600, which is made up of a series of PIN diodes. These diodes are used to amplitude modulate the oscillator output when in the SIG GEN mode. The also serve to attenuate the output signal and are controlled by the variable and step attenuator switches on the front panel. Output from the VCA goes to the Microwave mixer, 3500, where the final mixing takes place.

4.21 The other frequency required for the final mixing is generated by the 1300-2200 MHz oscillator, 3800, and phase lock, 3900. The reference is the 100 MHz output of the Frequency Multiplier, 2200, and the oscillator is controlled in 100 MHz steps by the most significant digit, 100 MHz, switch of the Frequency Selector dials. Individual oscillators are phase-locked to the 13th through the 22nd harmonic of 100 MHz.

4.22 The final microwave mixer output will be 10 kHz to 999.9999 MHz in the Signal Generator mode and 10-1009.9999 MHz in the Receive Monitor mode. This latter signal serves as the LO frequency for the RF plug-in.

4.23 The internal modulation frequency in SIG GEN is selected by the front panel SIG GEN MODULATION 1 kHz switch. For AM the modulating signal is routed through the Attenuator Control circuit, 3100, to the VCA circuit, 3600, where it controls a PIN diode modulator. For FM the modulating signal is applied to a VCO in the 10 MHz modulator circuit, 4400. The FM CAL control also is connected to the VCO so that the center frequency may be set exactly on by using the Monitor FREQUENCY meter. A feedback loop from the Modulator output is connected to the discriminator in the second IF Discriminator, 4700, to provide an AFC voltage which is also connected to the VCO in the modulator. An RF plug-in must be in the right hand compartment to complete the loop. The FM modulated 10 MHz output of the modulator goes to the 17.9-19 MHz mixer circuit where it is divided by 10 and mixed with the 20 MHz input to provide the 21 MHz mixing frequency required by this mixer for Signal Generation. In this way the output frequency is modulated.

External modulation is accomplished in the same way with an external modulating signal.

4.24 In the 1190-1300 MHz oscillator, 3700, 3750, to make sure that phase lock takes place at the proper frequency, a steering voltage is required to bring the frequency within locking range. This is supplied by the Reference Voltage, to the 1190-1300 MHz circuit from the Varactor Control on the 4800 board, which is controlled by the 10 MHz switch of the Frequency Selector dial.

CIRCUIT DESCRIPTION

Reference Divider. 2700

4.25 In this circuit, Figure 6-9, the 5 MHz output from the Time Base is processed to provide most of the fixed frequencies required for frequency synthesis. Outputs from this board are: 9.9 MHz for the second IF circuit, 1 kHz Reference 20% duty cycle to the 100 Hz Phase Detector, 100 kHz Reference 20% duty cycle to the 100 kHz Phase Detector, 10 MHz to the 10 MHz Modulator, and 1 kHz Logic Signal to the Audio Filter/Amplifier as the 1 kHz internal modulation frequency.

4.26 5 MHz Time Base output is divided by 5 in IC1 and by 10 in IC2 to obtain 100 kHz. Outputs IC2-8 and IC2-12 are buffered and combined in an AND gate in IC3 to produce a 20% duty cycle 100 kHz output to board pin 8. The other gates of IC3 are connected as buffers.

4.27 The 100 kHz output of IC2 is divided by 10 in IC4. The 10 kHz output of IC4 is divided by 10 in IC5. Outputs IC5-8 and IC5-12 are combined in a NAND gate in IC6 to produce a 20% duty cycle 1 kHz output through board pin 2. IC5-12 is connected to pin 2 of NAND gate IC6-1, 2, 3, which is controlled by the SIG GEN MODULATOR 1 kHz switch on the front panel through board pin 7 to turn the modulation on and off.

4.28 100 kHz from IC2 is also connected through a buffer IC3-4, 5, 6 to the input of the 3.3 MHz tuned amplifier, Q1-Q4, where the thirty-third harmonic is selected and amplified. Tuned amplifier, Q5, selects and amplifies the third harmonic of 3.3 MHz to produce a 9.9 MHz output at board pin 21.

4.29 An output from the 5 MHz Time Base is also connected to one side of a NAND gate in IC7. The other side of the NAND gate is connected to the Function switch S1007 through U4402-1, 2, 3. In the AM, CW, and CAL modes the gate is opened and closed in the FM and MON mode. The 5 MHz thus controlled is connected through the buffer amplifier of IC7 to the frequency doubler circuit, T1, Q6, Q7. The doubler output is passed through a 10 MHz filter to provide the 10 MHz output at board pin 16.

Frequency Multiplier. 2200

4.30 This circuit, Figure 6-4, furnishes the other three fixed frequencies required for frequency synthesis, 20 MHz to the 17.9-19 MHz mixer, 125 MHz to the 142.9-144 MHz mixer and 100 MHz as a reference for the 1300-2200 MHz phase lock.

4.31 Input to the circuit is 5 MHz from the Time Base. This sine wave input is amplified and shaped in Q1, Q2, IC1 to produce a 5 MHz pulse. This pulse is applied to the inputs of the X4 and X5 harmonic amplifiers. Q3, Q6, Q8 is a tuned amplifier that selects and amplifies the fourth harmonic to produce a 20 MHz output at board pin B. In the same manner the tuned amplifier, Q4, Q5, Q7, Q9, selects and amplifies the fifth harmonic to produce a 25 MHz output which is connected to the input of another set of X4 and X5 harmonic amplifiers. Q10, Q12, Q14, Q16 amplify the fourth harmonic to produce 100 MHz output at board pin N. Q11, Q13, Q15, Q17 amplify the fifth harmonic to produce 125 MHz output at board pin Y.

100 Hz Loop

4.32 The 100 Hz loop is made up of two circuits, 100 Hz Divide-by-N, 2600, and 100 Hz VCO and Phase Detector, 2800, Figures 6-8, 6-10. See also these circuits on overall block diagram, Figure 4-2.

4.33 The 2.00000-2.99999 MHz required by the 17.9-19 MHz mixer, 2400, is generated by this loop circuit according to the setting of the Front Panel Frequency Selector switches. This is accomplished by dividing down the 20.0000-20.9999 MHz output of the VCO in a divider controlled by the Frequency Selector switches to produce a 100 Hz output when the VCO frequency is correct. The 100 Hz output of the Divide-by-N circuit is compared with a 100 Hz reference frequency derived from the Time Base in a Phase Detector. Any deviation of the Divide-by-N output frequency from 100 Hz generates an error voltage in the Phase Detector. This error voltage is amplified and applied to the Varicaps in the VCO with a polarity such that the VCO output frequency is corrected to the proper value. In this manner any frequency dialed up on the Frequency Selector switches is referenced to the Time Base.

100 Hz Divide-by-N. 2600

4.34 Since the input to the Divide-by-N circuit is the VCO output of 20.0000-20.9999 MHz the divider circuit U2-U7 must be able to divide this input by 200.000-209.999 in order to always have a 100 Hz output. This is accomplished by setting the presettable dividers, U2-U5, to the nines complement of the front panel

Frequency Selectors. The front panel switches are wired to read out the nines complement of the number to which they are set. With the additional dividers, U6 divide by 10, and U2 divide by 2, it is possible to divide by up to 200,000. The circuits of U8, U1-4, 5, 6, 8, 9, 10, and U7-5, 7, 9 inhibit U-1, 2, 3 from allowing the first 10,000 count to go through from U5 to U6. This makes possible a division of up to 209,999. See Figure 6-8.

4.35 Input from the VCO, 2800, comes in through board pin 2 to the input amplifier/clock driver, Q1-Q4 and inverter, U1-11, 12, 13. This circuit not only provides the proper logic level, but also squares up the pulses so that there will be no ambiguity in clocking.

4.36 After the reset pulse, which presets the counters U2-U5 and resets to zero U7-12, U7-9 and U1-8, the counters U2-U5 count up to 9999 starting at the preset number. The count cannot go through U1-2, 3 because U1-1 is low. However U8 detects the 9999 count and sets U1-8 and therefore U7-7 high and at the same time clocks U7-5, but since both pulses arrive at approximately the same time U7-9 remains low. The divider U2-U5 starts over at zero and again counts up to 9999 and U8 again detects this condition. U1-8 is not changed, but U7-5 again receives a clock and U7-9 goes high so that the 20,000 count from U5 goes through to U6. At the count of 100,000 U7-12 goes high, enabling U11-3, and the count continues. When U6 reaches 9 on the last count through, U11-4 is enabled. At the continued count of 9993, in U2-U5, total count of 209,993, U9 detects this condition and U11-5 is enabled. With all the inputs of U11 enabled the next clock pulse, 9994 causes U11-8 to set high and the load/reset pulse for the counters is generated at U11-6. This reset pulse enables U12-1 allowing it to respond to the clock. Prior to the reset pulse, U12 is preset to the number 4 and U12 takes up the count at 209,994, with the clock input at U12-8. At the count of 9998 U12-12 enables the K input of U11 so that at count 9999, total 209,999, U11 resets and the counters start over again from the preset number. This 5-clock delay is necessary to give time for loading and reset of U2-U5. When U11-8 sets high at a total count of 209,994 this pulse also triggers the one-shot, U13, to generate the output pulse. When the frequency is correct according to the Frequency Selector setting this output will be 100 Hz.

100 Hz VCO and Phase Detector. 2800

4.37 Input from the 100 Hz Divide-by-N circuit comes in through board pin 19 through an inverter to the Phase Detector U2-3, see Figure 6-10. A reference frequency of 1 kHz from the Reference Divider, 2700, enters through board pin 18 and is divided by 10 in U1 and the 100 Hz output inverted and applied to the Phase Detector, U2-1.

4.38 The outputs of the Phase Detector, U2-2, 13 are both high (2.4V) when both 100 Hz Divide-by-N and the 100 Hz references are in phase. If the 100 Hz Divide-by-N input lags in phase U2-13 goes low and if it leads U2-2 goes low. These transitions are used to control the Unlock Detector circuit and to generate the VCO control voltage.

4.39 The Unlock Detector circuit is U3-1, 2, 3, 11, 12, 13 and U5 contains a one-shot, U5-1, 2, 3, 4, 5, 6, that triggers for every transition, but the output gate, U5-11, 12, 13 does not allow the one-shot output to pass through unless a transition is of more than 100μs duration. This is controlled by the 100μs delay of the circuit R4, C9.

4.40 The narrow pulses from U2 either add to or subtract from the 1.5 volt bias on C7, depending on whether the ÷N output leads or lags the reference. Q1 is an inverter and Q2 is an emitter follower. CR1-CR4 with R3 and R12 form a soft limiter at 2.4V. Q2, Q3 are used as low leakage diodes.

4.41 The Loop Amplifier U4 provides high DC gain to minimize the phase error between the ÷N input and the 100 Hz reference. C16-C18, R18-R20 is a notch filter to remove 100 Hz ripple. Q5-Q10 form active low pass filters for 50 Hz and 70 Hz to remove other residual signals. The DC control voltage is applied to the VCO, Q12, L2, CR5. Q13 is an output buffer for the 20-21 MHz output. Q11 is a power supply filter for the VCO.

4.42 To produce the required 2.0-2.1 MHz output an output from the VCO is buffered into the decade divider, U6. Output is filtered with the low pass filter L3, L4, C38-C40 and passes to the 17.9-19 MHz mixer, 2400.

17.9-19 MHz Mixer. 2400

4.43 In this circuit, Figure 6-6, the 2.0-2.1 MHz output of the 100 Hz VCO, 2800, is mixed with 20 MHz to produce the 17.9-18 MHz required for the Receive-Monitor function, or 1 MHz is mixed with the 20 MHz to produce 21 MHz, which is then mixed with 2.0-2.1 MHz to produce the 18.9-19 MHz required for the Signal Generator function. The selection of either condition is controlled by diode switches CR9-CR12.

4.44 When the Function switch is in the MONITOR position the voltage at board pin 9 is +20V and at pin 7 it is -12V. This turns diodes CR10, CR11 on and diodes CR9, CR12 off. 20 MHz from the Frequency Multiplier, 2200, through pin 8 passes through CR10, CR11 to T2 of the double balanced mixer T1, T2, CR1-CR4, R7, R9, R10, C13, C14. Here it is mixed with 2.0-2.1 MHz to produce 17.9-18 MHz. Output from T1 goes through a 19 MHz low pass filter and the level adjust control, R12 to output amplifier Q5 and the 17.9-19 MHz bandpass filter to board pin 21.

4.45 In the SIG GEN or CAL position of the

FUNCTION switch input to pin 7 is +20V and to pin 9 it is -12V turning CR9, CR12 on and CR10, CR11 off. 20 MHz is now connected to T4 of the mixer made up of T3, T4, CR5-CR8. The other input comes from the 10 MHz modulator through pin 4 to the 10 MHz amplifier, Q2, Q3, and decade divider, IC1, the 1 MHz output of which is connected to T3. Output from T3 is connected to the input of tuned amplifier Q1. It then passes through the 21 MHz bandpass filter to the tuned amplifier, Q4, through CR12 to the input of T2 in the double balanced mixer. This mixer output is now the 18.9-19 MHz required for the Signal Generator mode.

RF Mixers. 2100

4.46 Inputs to this circuit, Figure 6-3, are 125 MHz from the Frequency Multiplier, 2200, and 17.9-18 or 18.9-19 MHz from the 17.9-19 MHz mixer, 2400. These are connected to the balanced mixer T6, T7, CR5-CR8 through Balun transformers T5, T8. The Balun transformers are used to obtain a more accurate balance in the mixer. Mixer output is 142.9-143 MHz or 143.9-144 MHz. It passes through a bandpass filter to the tuned amplifiers Q3, Q4 to the 119-130 MHz mixer. This circuit is very similar to the 142.9-144 Mixer. Inputs from the 142.9-144 MHz mixer and 14-23.9 MHz from the 100 kHz loop are combined in the balanced mixer T2, T3, CR1-CR4 through the Balun T1, T4. 119-130 MHz output passes through a bandpass filter to the output amplifiers Q1, Q2 and to board pin Y.

100 kHz Loop

4.47 This loop is made up of two circuits, 100 kHz Divide-by-N, 2300, and 100 kHz VCO and Phase Detector, 2500. The VCO output is variable from 14-23.9 MHz. One output goes to the RF mixers, 2100, see block diagram, Figure 4-2. The other output goes to the Divide-by-N circuit, 2300, where control by the Frequency Selector 10 MHz and 1 MHz digits is introduced. Control is in increments of 100 kHz per step, but this is increased to 1 MHz per step in the X10 multiplication which takes place later on. Output of the Divide-by-N circuit is 100 kHz when the VCO frequency is correct. This output is compared with the 100 kHz reference frequency in a phase detector circuit, the output of which is amplified to use as a control voltage for the VCO.

100 kHz Divide-by-N. 2300

4.48 The purpose of this circuit, see Figure 6-5, is to divide the output of the 100 kHz VCO by a factor that will result in a 100 kHz output when the frequency is correct. Since the VCO output range must be 14-23.9 MHz the division range must be 140-239. The 14-23.9 MHz input goes through a buffer amplifier, Q1, to three gates U6, one of which, U6-6 is always enabled. For the beginning portion of the count U6-12 is enabled and U6-8 is low. The input through U6-12 goes to U3-8, the input of the three decade dividers U1, U2, U3.

4.49 The dividers are preset by the 10 MHz and 1 MHz Frequency Selector switches to the nines complement of the division ratio required. Thus if the division ratio is 140 (corresponds to a dial setting of 00) the dividers are preset to 999-140=859. For a division ratio of 239 (corresponds to dial setting of 99) the dividers are preset to 999-239=760. Since the most significant digit of the division ratio is only either 1 or 2, U1 is connected to be set only to the nines complement of 7 or 8. The dividers start counting from the preset number and count up to 993. At the count of 994 the dividers are reset to the preset number.

4.50 When U1, U2 each reach a count of 9 pins, 5 and 12 are high which causes a high on U7-5. The other two inputs, U7-4, 3 remain low until U3 has continued to the count of 3, at which time both pin 5 and 9 go high, which now makes U7-3, 4, 5 high so that at the trailing edge of count 994, U7 changes state. U7-6 goes low which resets the dividers U1, U2, U3 and also disables U6-12. At the same time U7-8 goes high enabling U6-8 so that the next count goes to U4-8 which has a permanently preset number equal to 5. Counts 995-998 bring IC4 up to a count of 9 which makes pin 5 and 12 high, making U7-10, 11 high so that the count of 999 causes U7 to change state. This disables U6-8 and enables U6-12 so that the next count starts a new sequence in U1-U3. At the same time U4 is reset to its preset number by the low to pin 1. The sequence then repeats. When the input frequency is correct the output from U7-8 to board pin 19 will be 100 kHz.

100 kHz VCO and Phase Detector. 2500

4.51 The VCO Oscillator, Q1, L4, CR2, CR3, covers the range of 14-24 MHz. See Figure 6-7. The varicaps CR2, CR3 are tuned by the voltage out of the phase detector U1, which compares the phase of the 100 kHz reference signal from the Reference Divider, 2700, with the 100 kHz output of the Divide-by-N circuit, 2300.

4.52 The error voltage out of the Phase Detector, U1, is filtered, R1, R3, C7, amplified in U4, and the control line connected to the varicaps through the low pass filter L1-L3, C12-C15. CR1 prevents the control line from going negative.

4.53 The Unlock Detector and Indicator Driver is made up of U2-8, 9, 10, 11, 12, 13 and U3. U308, 9, 10, 11, 12, 13 is a one-shot which turns on switch Q4 with a series of pulses in the unlocked condition to turn on the front panel indicator light. When the Phase Lock Loops are locked the input to U3-12 is low and the one-shot is not triggered. Whenever one of the loops goes out of lock the frequency drifts through the reference frequency at U2-9, 10 or U2-12, 13 causing a series of pulses to occur at U3-12 which trigger the one-shot and cause the front panel indicator to show an unlocked condition.

1190-1300 MHz Phase Lock. 3750

4.54 Output from the RF Mixer (2100) is connected to the input amplifiers through J1. Refer to Figure 6-18. Q1, Q5 amplify the signal sufficiently to properly operate the step recovery diode, CR2. R38 adjusts the bias on this diode. The step recovery diode acts as a capacitor that, on every cycle, returns the stored charge to the circuit very rapidly. The result is a very sharp pulse of approximately 500 psec duration. This pulse is applied to both T1 and CR4. The rectified output of CR4 is connected to the Automatic Level Control Amplifier IC2-2, the filtered DC output of which is connected to PIN diode CR1. The PIN diode functions as a resistance which may be varied according to the applied bias. Thus CR1 functions as an attenuator controlled by the output of IC2 to produce automatic level control. The reference voltage connected to IC2-3 is determined by the divider R43, R44, with CR3 providing temperature compensation.

4.55 The narrow output pulse from CR2 appears at the output of the secondary of T1 as a positive and a negative pulse (because the secondary center tap is connected to ground). These pulses are applied to the anode and cathode sides of the diode sampling bridge, Z1, to turn it on for a very short time. Since there is a fixed back bias on the bridge determined by CR9 and CR10 only the very narrow upper portion of the pulses turn on the bridge, giving a sampling width of approximately 100 psec.

4.56 The waveform that is sampled is the input from the 1190-1300 MHz VCO, 3700, which is brought in through J2 and connected across the sampling bridge. When the frequency of the VCO is correct every tenth cycle is sampled at exactly the same point on the waveform so the output of the sampling bridge to IC3 is constant. This output is filtered and stored by C35, C45, R55. If the VCO frequency tries to drift, sampling takes place at different places on the waveform and the output of the sampling bridge will go up or down depending on the direction of frequency drift.

4.57 DC output from IC3 is amplified by the differential amplifier, IC1, Q2 and the output is applied to the input of amplifier Q3, Q4. When the phase loop is locked, Q3, Q4 function as a differential amplifier, with Q6 not functioning in this mode. Q4 output is amplified by Q7, Q8 to become the varicap control voltage for the 1190-1300 MHz VCO, through board pin 5.

4.58 When the frequency is shifted out of locking range the output of the sampling gate, Z1, will be zero and the input to Q3 will be zero volts. When this occurs, Q3, Q4, Q6 function as a low frequency Wien bridge oscillator causing the VCO to swing through its frequency range. As soon as this frequency comes within the locking range there will be an output from the sampling gate and the loop will be closed. The high loop gain overrides the oscillator gain of Q3, Q4, Q6 and Q3, Q4 return to the amplifying function. R8 is an adjustment to set the input to Q3 at zero volts when there is no output from the sampling gate.

4.59 When the circuit is out of lock, search oscillator output from Q6 is connected through CR11 to Q10 turning it off. The oscillator pulses are stored as a DC level by C12, R27 to hold Q10 off. This low output from Q10 is fed through summing amplifiers Q3910, Q3911, Q3912 to the unlock detector circuit IC2503, IC2505 to turn on the UNLOCKED light.

4.60 An offset voltage from the Audio Amplifier and Varactor Control Circuit, 4800, is applied to the input of Q9 to set the varicap voltage according to the 1 MHz and 10 MHz Frequency Selector dial settings to bring the VCO into locking range for the frequency selected.

1190-1300 MHz Oscillator. 3700

4.61 Oscillator Q1 is connected in the common collector configuration and output is taken from the base. See Figure 6-17. The output tuned circuit is formed by the inductance in the board trace and the inductance and capacitance in the varicap, CR1. Frequency is controlled by the output of the phase lock circuit and the offset voltage from the varacitor control, 4800, which in turn is controlled by the 1 MHz and 10 MHz Frequency Selector switches. C2 is the coarse frequency adjustment. R4 adjusts the base voltage on Q3 which adjusts the bias on Q1, and thus adjusts the output amplitude. The traces from the emitter, base and varicap to the bypass capacitors are approximately one quarter wavelength and appear as RF chokes to the oscillator circuit. Output is coupled to the buffer amplifier, Q2, through C8. It then passes through a low pass filter, etched on the board, to the Voltage Controlled Attenuator. A directional coupler takes a sample of the oscillator output for the Phase Lock circuit and is connected through J1.

Voltage Controlled Attenuator. 3600

4.62 Two functions are performed by the Voltage Controlled Attenuator (VCA) circuit, amplitude modulation of the Signal Generator output when required and level control of the Signal Generator output. Both functions are accomplished by means of PIN diodes. Refer to Figure 6-16. In addition an automatic level control circuit maintains the input to the variable attenuator at a constant level, using the same attenuator as is used for modulation. In order to have matched input and output impedance through the attenuator the PIN diodes are connected as variable pi attenuator networks. In the modulator this is modified to satisfy the loading requirements of the oscillator.

4.63 In the attenuators the shunt diodes are all initially set for a fixed bias. When the series diodes are biased from the control circuits to be fully conducting, the fixed bias on the shunt diodes is set so that they just begin to come on

(they are at their high resistance value). As the bias on the series diodes is decreased by the attenuator control (to increase the series resistance) the voltage at the junction of the two sets of diodes changes to cause the shunt diode resistance to decrease. Thus each pi network becomes a very effective attenuator of the RF output. In the modulator attenuator the zero modulation level is set by the modulator DC output so that no clipping will occur on the positive modulation peaks. Attenuation range for the variable attenuator CR5-CR9 is 0-20 dB, and for the step attenuator CR10-CR13 the steps are 0-20-40 dB. The variable and step attenuators are both set with the front panel SIGNAL GENERATOR LEVEL controls.

4.64 Bias for the modulation attenuator, CR1, CR2, is controlled by R5. The variable attenuator bias is controlled by R11 through emitter follower amplifiers Q1, Q2 which provide current gain. The step attenuator bias is controlled by R19.

4.65 To provide Automatic Level Control (ALC) of the input to the variable attenuator a sample of the signal is taken with a directional coupler and rectified by CR4. To provide temperature stability another diode, CR3, is placed close to CR4 in the same temperature environment and the same DC bias is applied to both of them. CR3 is connected to the non-inverting input to the operational amplifier IC3451, the modulator detector amplifier mounted on the 1000 MHz Low Pass Filter board, 3450, and CR4 to the inverting input. In this way DC variations due to temperature changes are cancelled out.

4.66 The detected RF output from IC3451 is connected to the inverting input of operational amplifier IC3102 mounted on the Attenuator Control Board. Output from this amplifier, through buffer amplifier Q3103 is connected back to the VCA board as the control voltage for CR1 to accomplish the ALC function. The other input to IC3102 is from the modulating source. This causes the output of IC3102 to vary at the modulation frequency. Since this output controls the modulation attenuator CR1, CR2, the RF signal is amplitude modulated. Thus both ALC and Modulation are accomplished with the modulation attenuator. Output from the attenuator passes through J1 to the Microwave Mixer, 3500.

1300-2200 MHz Phase Lock. 3900

4.67 The 1300-2200 MHz Phase Lock circuit, Figure 6-20, is the same as the 1190-1300 MHz Phase Lock. See paragraphs 4.54-4.60 for description. The differences are that no offset control is required. Included on this board are the summing amplifiers, Q10, Q11, Q12 for the Unlocked indication.

4.68 Input reference to Q1 is 100 MHz from the Frequency Multiplier, 2200. The VCO output sample to the sampling gate is 1300-2200 MHz. Control output from Q9 passes through board pin 12 to the 1300-2200 VCO.

1300-2200 MHz Oscillator. 3800

4.69 The purpose of this oscillator is to furnish frequencies at 100 MHz intervals to the Microwave Mixer. This is accomplished by using ten fixed frequency oscillators which are switched on one at a time according to the setting of the 100 MHz dial of the Frequency Selector switches. See Figure 6-19. The circuits of the ten oscillators are the same except for the values of the elements forming the tuned circuits. For the three highest frequencies the transistors used have a higher frequency specification than the others.

4.70 The transistors Q1-Q10 are soldered directly into the transmission lines etched on the circuit board. Parts of the line are expanded to form reactive elements. Oscillator number 1, 2.2 GHz is typical of the ten and will be used for the description. (Figure 6-19). The 100 MHz Frequency Selector switch connects -12V to the emitter of Q1 through bias adjusting resistors R1, R11, R21. The varicap control voltage from the 1300-2200 MHz Phase Lock circuit is brought in through terminal 2 and through R31, C31, RFC L1 to the proper point on the transmission line.

4.71 C21 is connected to the transmission line one quarter wavelength from the emitter of Q1. This transforms the capacitive reactance to an inductive reactance at the emitter so that the quarter waveline appears as an RFC. The internal input capacitance of the transistor is part of the feedback network. Feedback necessary for oscillation takes place through the internal collector to emitter capacitance. The etched area of the transmission line connected to the collector of Q1 is enlarged in area and forms the inductive part of the tuned circuit. The circuit is tuned by the output capacitance of the transistor. The output capacitance varies with the width of the depletion region at the collector to base junction. Since the depletion region width, and therefore the output capacitance, varies with applied collector voltage this is used to fine tune the oscillator. The control voltage is connected to the collector through L1 and thus provides fine tuning control. Between the point at which L1 is connected and C41 is a quarter wavelength. Thus the capacitance of C41 is transformed into an inductance at the point at which it is connected to the collector tuned circuit and in this way forms a coarse tuning adjustment for the oscillator.

4.72 Each oscillator is capacitively coupled to the 50 ohm output transmission line by an etched-in capacitance. A directional coupler is also etched on the board to sample the signal on the output line for the phase lock circuit.

4.73 Output from the 100 MHz-per-step LO is connected to the primary of the mixer T1, CR1, CR2, Figure 6-15. RF from the Voltage Controlled Attenuator is fed to the junction of the

mixer diodes CR1, CR2 through the 50 ohm attenuator CR3, CR4, CR5. 0-1000 MHz or 10-1010 MHz is taken out through J2.

4.74 The calibration attenuator is a pi configuration of PIN diodes. Fixed bias is applied to CR3, CR5 so that they have a low resistance when CR4 is biased for high resistance. As current through CR4 is increased the voltage at the junction of CR4, CR5 increases so that CR3, CR5 are biased toward a higher resistance as CR4 is biased for lower resistance. In this way the attenuator is maintained at a 50 ohm impedance over its full attenuation range. Calibration Level control R3120 sets the attenuator to the calibrated level. When the FUNCTION switch is in the MONITOR position the VCA and the mixer attenuator are biased for minimum attenuation.

1000 MHz Low Pass Filter. 3450

4.75 This board, Figure 6-14, includes the modulator detector amplifier, IC1, which was described in paragraph 4.65, 4.66. This circuit board also has a 1000 MHz low pass filter etched on the board through which the output from the microwave mixer passes. The filter removes the high order frequencies generated in the mixing process.

RF Switch. 3200

4.76 The RF Switch, Figure 6-13, routes the Frequency Synthesizer output to the output connector or to the RF plug-in unit. The switches are PIN diodes and only one switch is on at a time. +20V applied to the junction of one of the diode pairs, CR1, CR3 or CR2, CR5 turns on the switch while -12V turns it off. CR4, CR6 are turned on by the -12V to provide a low impedance path to ground so that there will be no signal feedthrough when the switch is off.

4.77 With the FUNCTION switch in the SIG GEN position, switch CR1, CR3 is closed. This connects the signal to the 0-1000 MHz output connector. With the FUNCTION switch in the MONITOR position switch CR2, CR5 is closed and the signal goes to the plug-in as the LO signal.

Audio Amplifier and Varactor Control. 4800

4.78 The Varactor Control section of this circuit, Figure 6-23, supplies the offset voltage required to set the 1190 MHz-1300 MHz Voltage Controlled Oscillator within the proper locking range whenever the 10 MHz or the 1 MHz Frequency Selector dials are changed as noted in paragraph 4.60. When switching between SIG GEN and MONITOR an additional offset is required from this circuit because of the 10 MHz shift in output frequency. The output offset voltage is supplied by operational amplifier U2.

4.79 The inverting input, U2-2, is connected to a current summing junction of all the control currents. Current is supplied through R21 to the junction of R22 and the calibrating resistors R1-R20. U1 is binary to decimal decoder and the input to it is the output of the 10 MHz Frequency Selector switch. When a number is selected on the 10 MHz Frequency Selector dial, the binary output of the selector switch is decoded by U1 and the selected output is brought low. This changes the current flowing to the operational amplifier, U2, and thus changes the output voltage.

4.80 In a similar way the 1 MHz switch digits 0-2 supply +20V through board pin U and R25 to the input of U2, digits 3-5 supply +20V through board pin W and R24, R26 and digits 6-9 supply zero volts through these inputs to provide the required offset for this switch. In the MONITOR setting of the FUNCTION switch -12V is applied through board pin V, CR1, R27 to U2-2 to offset the frequency by the required 10 MHz.

4.81 Modulating signals are connected to the modulation pre-amp, U3A-6 either through board pin J for the external MOD INPUT connector or from the 1 kHz output of the Reference Divider, 2700, through the 1 kHz Shaper, Q1, Q2. Output from U3A is amplified by U3B and U4 and the output connected directly through board pin N to the 10 MHz VCO for FM modulation. Output is also taken through U6B to the MOD OUT front panel connector. In addition U6A is the AM Driver for the modulator in the Voltage Controlled Attenuator, 3600. The AM Driver, U6A, is inhibited in all positions of the FUNCTION switch except AM by the control line through board pin P. CR3, CR6, R35 form a clamp circuit to prevent overloading the Voltage Controlled Attenuator when AM is not used.

4.82 Demodulated FM from the Second IF/Discriminator, 4600, comes in through board pin E to the Audio Pre-amp, U5A. One output from U5A goes to the front panel DEMOD OUT connector. The output also goes to the front panel VOLUME control through board pin F and back from the control through board pin C to the Audio Power Amplifier, U5B, Q3, Q4, and then to the internally mounted speaker.

Attenuator Control. 3100

4.83 The attenuator control, Figure 6-12, furnishes the required voltages for the proper functioning of the PIN diode attenuators in the Voltage Controlled Attenuator, 3600 (see paragraphs 4.62-4.66) for the operation of the Calibration Attenuator in the Microwave Mixer, 3500 (paragraph 4.73), and to furnish a modulated output to the AM monitor plug-in through board connections P3101-2.

4.84 Output from the Modulation Detector Amplifier on board 3450, is connected to the inverting input of IC2 and through buffer amplifier, Q3, and goes to the PIN diode modulator in the Voltage Controlled Attenuator (VCA), 3600, to provide automatic leveling of the signal. The modulating signal enters through P3101-3, passes through buffer amplifier, Q2, to the non-inverting

input of IC2 and thus modulates the attenuation of the PIN diode attenuator. R16 is the calibration adjustment for modulation level and R7 sets the attenuation to 8 dB with no modulation.

4.85 The front panel variable attenuator control, R1004, is a variable voltage divider with a range of zero to 2V, the maximum voltage being set by R14. This voltage level is brought in through P3101-7 to the non-inverting input of IC3. The output goes to the PIN diode attenuator in the VCA. Connected to the inverting input of IC3 is the shaping network necessary to convert the linear rotation of the variable attenuator control to the log characteristic of the PIN diode attenuator. R27/28 fixes the break point, R44 sets slope 1 and R50 sets slope 2, R39 sets the maximum attenuation. Q7, Q8 are current sources, while R46 provides temperature compensation.

4.86 Control for the PIN diode Step Attenuator enters from the front panel function and level switches at P3101-4 and goes to the PIN diode attenuator through P3102-A. When the SIGNAL GENERATOR LEVEL switch is in the +40 dB position, +20V is connected directly through to the attenuator and level output is set by calibration level control R26. In the +20 dB position the input to P3101-4 is open (zero volts) and the level setting of the PIN diode attenuator is determined by adjustment of R40 which is adjusted to set the level 20 dB lower than in the +40 dB position. In the 0 dB position -12V is connected to P3101-4. Diode CR2 isolates this voltage from the rest of the circuit but R5, R6 are turned on to form a voltage divider between +20V and -12V, the level of which is set by R37. This adjustment brings the output 40 dB below the +40 dB position. The Signal Generator output is calibrated by adjusting R26 as noted above.

4.87 In the MON position of the Function switch all the PIN diode attenuators in the VCA and the microwave mixer are turned on (minimum RF attenuation). +20V applied to P3101-D turns on Q1 which sets the modulation attenuator to 0 dB; the calibration attenuator is set to 0 dB through CR3 and the variable attenuator is set to 0 dB through CR1. +20V to P3101-4 turns on the step attenuator through CR2, and through P3101-D turns off the modulator buffer amplifier Q2 so that modulation may not be applied.

10 MHz Modulator. 4400

4.88 This circuit, Figure 6-21, furnishes the required 10 MHz for the SIG GEN mode of operation (paragraph 4.45). In CW or AM the 10 MHz comes from the Reference Divider, 2700, through board pin C and then either directly out to the plug-in through board pin D, or through buffer amplifier Q5, and out through board pin B to the 17.9-19 MHz mixer.

4.89 In the FM mode a high FM (switching) level to Q1 turns on Q1 so that +20V is applied to the VCO, turning it on. This +20V through CR3 and R1 forces the Discriminator (4600 board) to unsquelch. The varicap, CR4, which determines the VCO frequency, is controlled from three sources. The modulating signal, either internal or external, is applied through board pin F to FM the VCO, Q3, L2, CR4. The AFC voltage from the 2nd IF and Discriminator circuit through board pin H also controls the frequency to complete the AFC loop. The FM CAL control from the front panel comes in through board pin E to adjust the center frequency. Output is through buffer amplifier Q4 and Q5 and board pin B to the 17.9-19 MHz Mixer, 2400.

4.90 The FREQUENCY meter calibration circuit is also on this board. The meter is effectively connected between the discriminator output at board pin H and pin J. CR1, CR2 are the shunt overload diodes. R13 is the shunt calibrating resistor. R3-R5 are the variable and R9-R11 are the fixed series calibrating resistors. Board pin L goes to the 15 kHz range switch position, pin M to the 5 kHz and pin S to the 1.5 kHz position.

4.91 Board pins R and T go to ground closure contacts on the FUNCTION switch, S1007, at FM and MON positions. The level is inverted in U2 to provide FM and MON levels and used directly for $\overline{\text{MON}}$. FM controls the 10 MHz VCO switch and MON and $\overline{\text{MON}}$ control the SIG GEN Select Driver, Q11, Q13, Q15, Q17, Q18 and the Monitor Select Driver Q12, Q14, Q16, Q19. Output from each driver is either +20V or -12V DC. SIG GEN Select Driver output through board pin W goes to the RF switch, 3200, to 1190-1300 MHz oscillator, 3700, and also to the 17.9-19 MHz Mixer, 2400. Monitor Select Driver output through board pin Y goes to the RF switch, 3200, and to the 17.9-19 MHz Mixer, 2400. FM and MON switch levels also operate the 10 MHz Ref. enable switch U2-1, 2, 3, which controls the 10 MHz Ref output from the Reference Divider, 2700.

4.92 Board pins U and V are connected to the Step Attenuator switch, S1010, and receive a ground closure to either one, or to neither, to control the Step Attenuator pin diode in the Voltage Controlled Attenuator, 3600. Each input goes through NAND gates U1-4, 5, 6 and U1-11, 12, 13 which are controlled by the $\overline{\text{MON}}$ level from the FUNCTION switch. This sets the attenuator to minimum insertion loss in the Monitor mode to supply the LO signal to the plug-in unit. The Step Attenuator Drivers Q6-Q10 supply either +20V, -12V or zero volts through board pin X to the Attenuator Control, 3100, for control of the Step Attenuator.

Second IF/Discriminator. 4600

4.93 The Second IF mixer takes the 10 MHz from the plug-in and the 9.9 MHz from the Reference Divider and mixes them to produce a 100 kHz output. See Figure 6-22. Since the plug-in output will be 10 MHz ± the frequency error, the mixer output will be 100 kHz ± the frequency error. The 9.9 MHz output is amplified by tuned amplifier Q7 and the 10 MHz by tuned amplifier IC1. The outputs

go to IC2 which is connected as a mixer. Output passes through a bandpass filter to Q8.

4.94 The 100 kHz signal from IC2 is amplified by Q8 and applied to squaring circuit Q9. The output of Q9 is differentiated, R42, C33, and the positive pulses are passed by CR3 to trigger a one-shot multivibrator, Q10, Q11. The one-shot can operate only when the received signal is strong enough to turn on Q3 which then connects the emitters of Q10, Q11 to ground.

4.95 The one-shot output has a pulse width of 5 microseconds (one-half the period of 100 kHz) at the collector of Q11. This pulse width remains the same throughout a frequency error range of from 75 to 125 kHz. The width between pulses, however, depends on the interval between input pulses (pulse frequency) and therefore will be longer for a lower frequency and shorter for a higher frequency. The duty cycle will therefore vary with frequency and will be 50% only when the frequency is 100 kHz. Output at Q10 collector will be the opposite of that at Q11. The outputs from Q10, Q11 collectors are connected to a meter bridge circuit. See Figure 4-1.

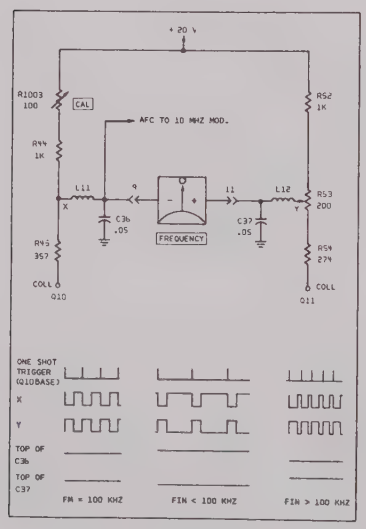


Figure 4-1. Frequency Meter Bridge Circuit

4.96 The outputs of Q10, Q11 are averaged in the circuits L11, C36 and L12, C37. Refer to Figure 4-1. When the intervals between pulses are longer than the pulses the voltage at the top of C36 rises and that at C37 goes lower and the meter deflects to indicate below center frequency. When the intervals are shorter than the pulse the voltage levels are the opposite and the meter deflects to the high frequency side. When the pulses and intervals are equal (50% duty cycle) there is no voltage difference between the two capacitors and the meter rests on zero. An FM signal averages out across the meter and does not affect the reading.

4.97 R53 is the calibration adjustment for the meter. R1003 is the front panel CAL control to set the meter to zero when the internal calibration 10 MHz signal is applied to the second IF mixer. The calibration adjustments for the different meter ranges are R4403, R4404, R4405 located on the 10 MHz modulator board.

4.98 The Signal Level Detector is operated by a voltage output from the plug-in to board pin 15 that is proportional to signal level. When this voltage reaches a level of 1 volt the Schmitt Trigger Q1, Q2 changes state and turns on switch Q3. This enables the meter one-shot Q10, Q11 by providing a connection to ground for the emitters, and also connects one side of the SIGNAL LEVEL light to ground, turning it on.

4.99 The FM, still present on the signal at the collector of Q11, is fed through the isolation diode CR11 to the base of emitter follower, Q4. The output of Q4 goes through a low pass filter to remove the carrier frequency. The audio output is connected to the oscilloscope plug-in through pin 2. It is also connected to the base of emitter follower, Q5, the output of which goes to the power amplifier on the Audio Amplifier board, 4800, and then to the speaker.

Power Supply Regulator. 5100

4.100 The Power Supply/Regulator board, Figure 6-25, is mounted on the rear panel. The rectifier blocks, Z1-Z3 are bolted to the board but are in contact with the rear panel to provide them with a heat sink. The series regulator transistors, Q5001, Q5002, Q5003, are mounted on the rear panel, under the cord bracket, to provide them with a heat sink. Each regulator is fused, the fuses being mounted on the 5100 board.

4.101 The regulators are conventional. CR4, CR5, CR6 are the reference diodes, error amplifiers are Q7, IC1, IC2 and regulator driver amplifiers for the series regulators are Q1, Q2, Q3. Resistors R10, R11, R12 are current sampling resistors for overload current control transistors Q4, Q5, Q6. Output voltage adjustment is provided for each supply by the controls R17, R21, R24. The +20V and +5V supplies are tied together in that the +5V reference is taken from the +20V output. Zener diodes CR7, CR8, CR9 prevent excessive power supply output on turn-on, or in case of a circuit malfunction.

TONE GENERATOR, M10 OPTION

4.102 The Tone Generator is available as optional equipment when the need exists for audio modulating frequencies other than the 1 kHz tone available in the CE-4.

4.103 The only change in the CE-4 is an additional connection on the 4800 circuit, Audio Amplifier and Varactor Control, where a connection from pin K through R70 is connected to U3A-6. See Figure 6-29.

Functional Description

4.104 Tone generation begins with a crystal oscillator. The oscillator output frequency passes through a rate multiplier where it is multiplied by some fraction of one, according to the front panel FREQUENCY switch settings. It may then be divided by ten or one hundred or passed through directly according to the front panel range switch setting.
q
4.105 The signal then goes to an up/down counter and a digital to analog (D/A) converter where a triangular wave is produed consisting of a large number of steps (510 steps per cycle), each step produced by one cycle of the output frequency of the rate multiplier/range divider. The triangular wave then passes through a sine converter where it is converted into a sine wave having less than one percent distortion.

4.106 The sine wave output passes through an output gate, a FET switch, which is turned on and off by the burst time generator, or biased on for continuous tone output, according to the setting of the BURST control. An output amplifier provides the required output signal. The amplitude of the output is adjusted by the front panel LEVEL control.

Circuit Description

Frequency Synthesizer. 4900

Time Base

4.107 The Time Base is a crystal controlled oscillator, Q1, Y1. Fine adjustment of the output frequency is provided by adjustable capacitor C2. The oscillator output is buffered by part of U1 to provide a logic signal output, which is the clock input to the Digital Rate Multiplier. See Figure 6-30.

Digital Rate Multiplier

4.108 Four integrated circuits U3, U4, U5, U6 make up the Digital Rate Multiplier. The output rate of each rate multiplier unit at the Z or Y output is determined by the setting of the front panel FREQUENCY switch connected to that unit. The switches are wired for BCD (0-9). See Figure 6-31 and 6-28. When a switch is set to a decimal number, for every 10 clock input pulses there will be the number of output pulses to which the switch is set, that is, if the switch is set to 7, there will be 7 output pulses for every 10 clock pulses.

4.109 When the Enable output, pin 7, is connected to the following Enable input, pin 11, the multipliers are decaded, that is, there is one Enable output pulse for every 10 input clock pulses. When the Enable Out is connected to the following Enable In of the four multipliers, it gives the same effect as though the clock rate of U4 were divided by 10, to U5, divided by 100, and to U6 divided by 1000.

4.110 The outputs of U3 and U4 are ORed together, using the Internal OR gate in U4, by connecting the Z output, pin 5 of U3 to the CASC input pin 12, on U4. U5 and U6 are connected in the same manner. The ORed outputs appear at the Y outputs, pin 6, of U4 and U6. These outputs are ORed together in the external OR gate made up of part of U1 and U2. In this way the total output of the four rate multipliers appears as a single frequency to be applied to the up/down counter. This output may be applied directly to the up/down counter when the range switch is set to X1.0, or divided by ten, range switch set to X0.1, through the decade divider U7, or divided by 100, range switch set to X.01, through both decade dividers U7, U8.

Up/Down Counter

4.111 The Up/Down Counter is made up of two synchronous, reversible up/down counters, U9 and U10, each having four binary outputs. The ripple clock output, pin 13, of U9 is connected to the clock input, pin 14, of U10 making them effectively one up/down counter having eight binary outputs. The up/down count is controlled by J-K flip-flop, U11, which is triggered to change state on the coincidence of max. or min. outputs from the two counters. The eight binary outputs provide a total count of 255 in each direction, or a total of 510 for each cycle of up/down operation. These outputs are connected to the D/A converter, U12.

D/A Converter

4.112 The D/A Converter changes the linearly progressing binary input count to a linearly increasing or decreasing, depending on the direction of the count, output current. The current increases or decreases in small steps, one step for each count. This produces a triangular current waveform having a total range of zero to 2 mA from minimum to maximum. One cycle of this waveform is produced by 510 input counts to the D/A Converter.

4.113 The D/A output is connected to operational amplifier U13, which is given a DC offset, +5V applied through R22, so that the output triangular waveform of the amplifier is centered between ± 1 mA.

Sine Converter

4.114 The Sine Converter, which is an active filter, takes the triangular wave output of U13 and converts it into a sine wave. The filter makes use of the fact that in a field effect transistor (FET), for a fixed gate voltage, the drain current as a function of drain voltage between zero and

pinch-off resembles a quarter sine wave. Since drain and source are symmetrical they may be switched back and forth to provide a complete sine wave. The FET transistor is Q2 and CR1, CR2 are the switching diodes. Adjustment for minimum distortion is made by adjusting the input level with R23 in the feedback loop of U13, and the source resistance, R28. Output level to the following buffer amplifier, U15, is adjusted by R29.

Output Gate

4.115 The Output Gate is an FET switch, Q5, that is turned on or off by the output of the Level Translator, Q3, Q4, which is controlled by S1103 through NAND gate U2-1, 2, 3, 8, 9, 10. When switch S1003 is not in the OFF position S1013 selects either continuous tone or tone bursts when S1014 is depressed. The output of Q4 back biases CR3 to turn on Q5. The signal then passes to the front panel LEVEL control, R1002.

Output Amplifier

4.116 From the LEVEL control the signal passes to the Output Amplifier, U16, which provides the required output voltage. U16 is an operational amplifier capable of providing 3.0 volts output across 600Ω. R30 is a thermistor which provides temperature compensation.

Burst Time Generator

4.117 In the BURST mode the burst time is controlled by the timing unit U14. The time that U14 delivers a positive output to Q3 to turn on the output gate is determined by the timing resistors R35, R1005 and capacitors C15, C16. (The time is t = 1.1 RC, where R = R35 + R1001 and C = C15 + C16). R1005 is the front panel, Figure 1-1, BURST (SEC) control. Thus when R1005 is minimum the burst time is .03 seconds, and at maximum it is 1 second. The BURST is keyed on by the front panel ENABLE control. R31, C14 differentiates the start pulse to a short spike to properly trigger the timing unit, U14. One burst will be delivered each time the ENABLE control is depressed.

HIGH LEVEL AMPLIFIER, M11 OPTION

4.118 An available High Level Amplifier, M11 Option, has a typical uncalibrated signal output level of -30 dBm to +10 dBm (7mV to 700mV) from .01 MHz to 512 MHz, with a maximum output at 999.9999 MHz of >-7 dBm (100mV RMS).

4.119 Changes necessary are to add one switch to the Front Panel, add High Level Amplifier and Wide Band Amplifier Fuse Assemblies, exchange RF Switch assemblies, and make changes in cable connections as shown in the Microwave Casting Interconnection Diagram, 3000, Figure 6-11.

Functional Description

4.120 The Frequency Synthesizer output is routed by the RF Switch to either the Front Panel 0-1000 MHz connector, the High Level Amplifier, or the RF plug-in unit as the L.O. signal.

4.121 In the High Level Amplifier the signal is amplified to produce an output level at the Front Panel High Level connector (when selected) of up to +10 dBm.

4.122 The High Level Amplifier is protected against the application of excessive voltage levels at the High Level output connector by the Wide Band Amplifier Fuse Assembly.

Circuit Description

4.123 RF SWITCH. 3200, M11

4.124 The RF Switch, Figure 6-33, routes the Frequency Synthesizer output to either of the two output connectors or to the RF plug-in unit. The switches are PIN diodes and only one switch is on at a time. +20V applied to the junction of one of the diode pairs, CR1, CR4 or CR2, CR6 or CR3, CR7 turns on the switch while -12V turns it off. CR5, CR8 are turned on by the -12V to provide a low impedance path to ground so that there will be no signal feedthrough when the switch is off.

4.125 With the FUNCTION switch in the SIG GEN position, and the High Level switch not selected, switch CR1, CR4 is closed. This connects the signal to the 0-1000 MHz output connector. If the High Level switch is selected, switch CR2, CR6 is closed and the signal is routed to the High Level Amplifier. With the FUNCTION switch in the MONITOR position switch CR3, CR7 is closed and the signal goes to the plug-in as the L.O. signal.

4.126 HIGH LEVEL AMPLIFIER. 3300, M11

4.127 IC1, Q5, Q6 are wide band amplifiers capable of producing +10 dBm into 50 ohms over a frequency range of 20 MHz to 1000 MHz. See Figure 6-34. Q1-Q4 are wide band amplifiers that work over the range of 10 kHz to 20 MHz, capable of producing an output of +10 dBm over this range. The two sets of amplifiers work in parallel to cover the full 10 kHz to 1000 MHz High Level range of the instrument. The amplifier is switched on by applying +20V to pin 1 when the FUNCTION switch is in the SIG GEN position and the HIGH LEVEL switch has been selected.

4.128 WIDEBAND AMPLIFIER FUSE ASSEMBLY 3050, M11

4.129 Overload protection for the wideband amplifier is provided on this circuit board, Figure 6-32. Fuse, F1, and diodes CR1-CR4 protect the amplifier from excessive voltages which might be applied to the output connector.

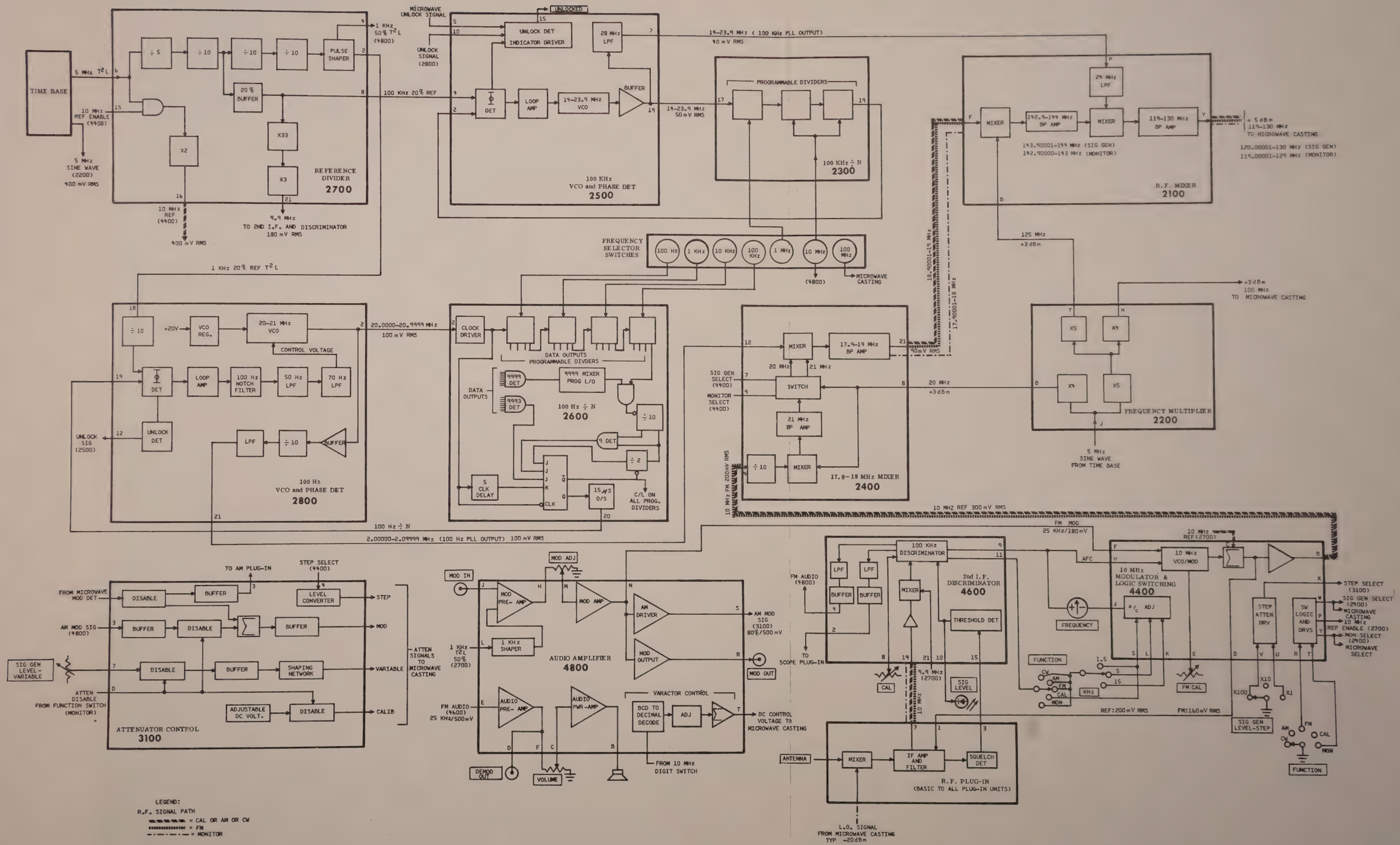


Figure 4-2. CE-4 Overall Block Diagram, Main Frame

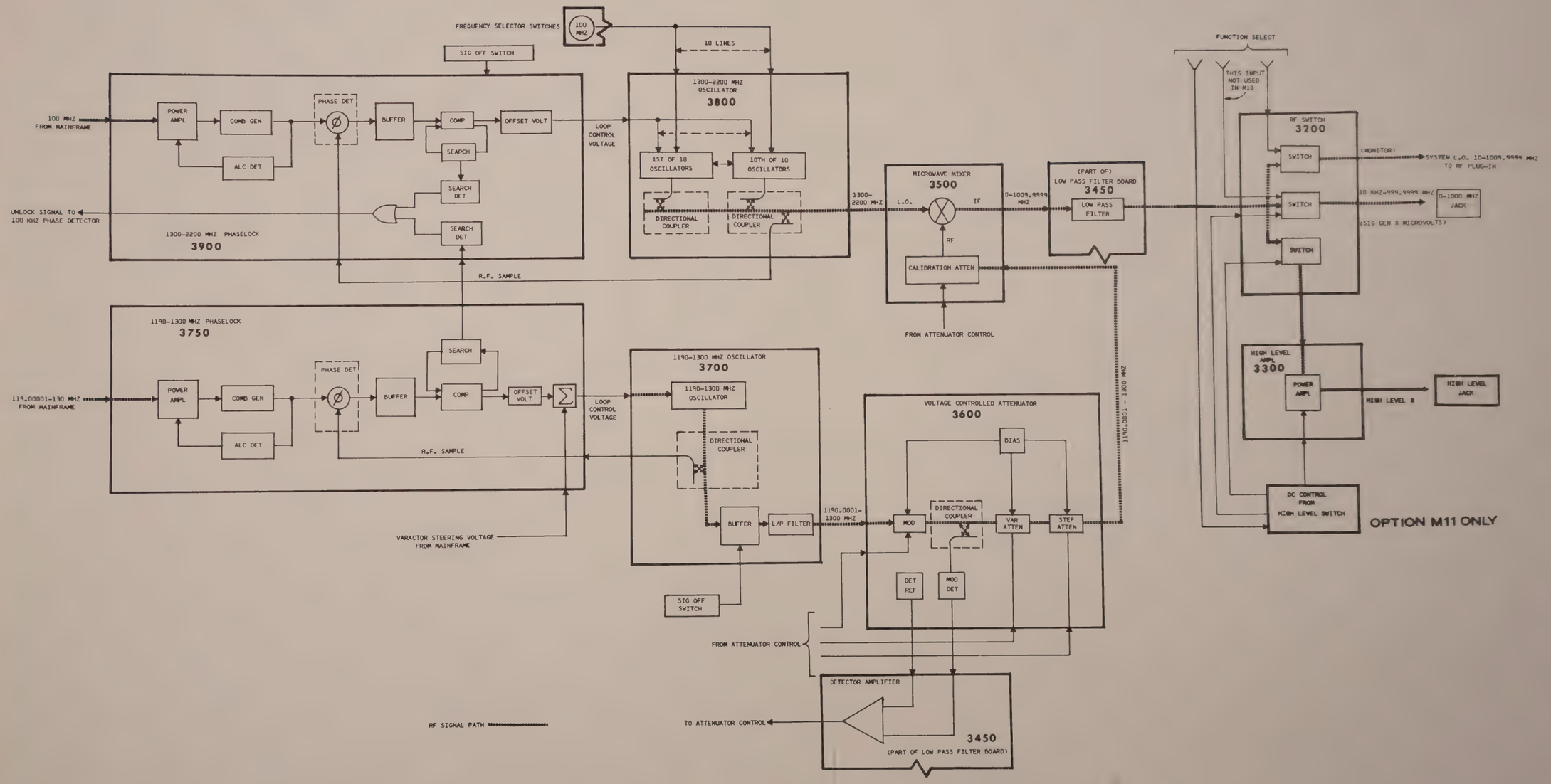


Figure 4-3. CE-4 Block Diagram, Microwave Casting

SECTION 5
MAINTENANCE

GENERAL INFORMATION

5.01 This section of the manual is divided into two parts: "Adjustment" and "Troubleshooting". It is recommended that for adjustments other than those described, the faulty sub-assembly or the entire instrument be returned to Cushman Electronics, Customer Service Department, for calibration and alignment. Refer to paragraph 2.05, 2.06.

5.02 In the following discussions it is assumed that the technician is familiar with the operating procedures described in Section 3.

5.03 The instrument should be warmed up for 30 minutes before any adjustment is attempted.

Access and Parts Location

5.04 Components in the top part of the instrument can be reached by removing the side covers. Each cover is held in place by six screws. The speaker leads must be disconnected before the right hand cover can be removed completely. Speaker leads should be secured so that they will not short to the chassis. Stand the instrument on its back to remove the bottom cover. This will expose all the circuit boards that plug into the chassis.

5.05 Figure 5-1 shows the location of the circuit boards in the bottom of the instrument. The same drawing is screened on the inside of the bottom panel. The component identification drawings on the inner leaf of the circuit board schematics show the location of the adjustable components.

5.06 The fuses for the three regulated power supplies are on the rectifier board which is mounted on the inside of the rear panel near the upper left hand corner. The board is marked with the voltage to identify each fuse. The fuse for the oscilloscope plug-in is mounted above the jack of the left hand plug-in jack panel. The main fuse is mounted on the rear panel near the power cord and is accessible from the outside of the instrument.

5.07 A board extractor and an extender board are furnished. They are inserted in a compartment in the bottom of the instrument. Before removing or inserting a circuit board, be sure to turn off the power to the instrument.

5.08 All available adjustments in the center casting are accessible through the casting covers and are appropriately marked.

ADJUSTMENTS

Equipment Required

5.09 The following instruments or their equivalent may be used.

Oscilloscope	HP 180A
Digital Multimeter	HP 10004B
20 dB Fixed Attenuator	Weinschel 50-20

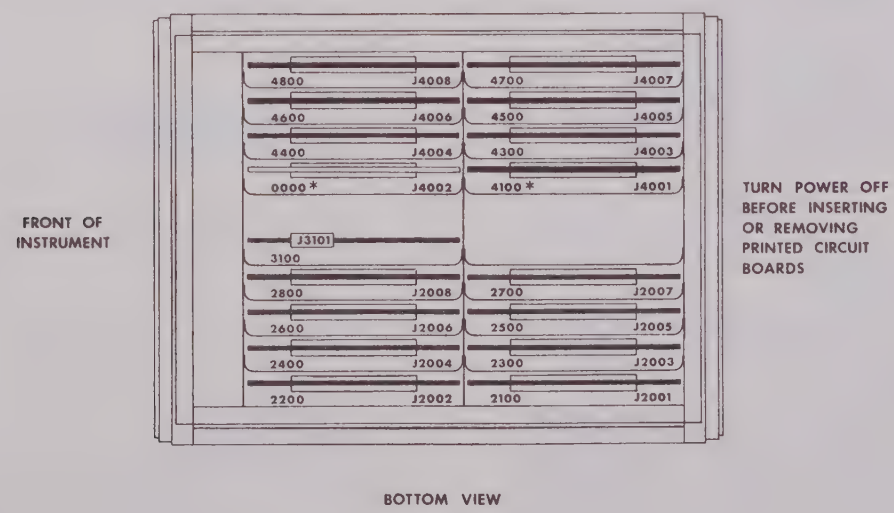


Figure 5-1. Circuit Board Location

* With M10 Option installed, 0000 becomes 4900; 4100 becomes 0000.

40 dB Fixed Attenuator	Weinschel Model 50-40
VHF/UHF Receiver	CE-5 or CE-6A with a 304 (B) or 305 (B) plug-in
Signal Generator	HP 8640
Power Meter	General Microwave 460B and Power Head N422C
Electronic Counter	EIP 350C
Wide Band Amplifier	HP 8447D

Power Supply Voltages

5.10 Remove the side covers of the instrument and measure voltages at the marked terminals on the left side of board 5100, which is mounted on the rear panel. Adjustment controls are adjacent to the terminals.

NOTE

The regulated power supplies are set to within 20mV of the rated output at the factory. They should not be adjusted unless a voltmeter with greater accuracy is available.

a. Measure the +20V with the DMM at terminal 15 (red wire). Adjust R21 for +20V ± 0.02V.

b. Measure the +5V at terminal 13 (green wire). Adjust R17 for +5V ± 0.02V.

c. Measure the -12V at terminal 14 (orange wire). Adjust R24 for -12V ± 0.02V.

1300-2200 MHz Phase Lock Loop

5.11 Remove plug button. Insert the X10 probe through the hole in the center casting right rear cover plate, marked 3900, and connect to the U-shaped wire directly under the hole.

a. Set oscilloscope (or DMM) to 1V DC and connect X10 probe to oscilloscope input.

b. Step the 100 MHz frequency selector dial (most significant digit on left) through 0-9. Observe voltage at each step.

c. Adjust the appropriate capacitor on the 3800 board for DMM reading of -0.4V DC. Holes on the cover plate over the 3800 board are marked 1.3 to 2.2. The proper capacitor is 0.1 the dial setting plus 1.3. Dial 0 is 1.3, dial 1 is 1.4, etc. (Remove four flat head screws from bottom of plug-in tray and move out of the way to reach rear adjustments).

d. Recheck voltages after making adjustments. Voltage may be between -0.3 and -0.5V, preferably close to -0.4V. Remove probe.

1190-1300 MHz Phase Lock Loop

5.12 Insert the X10 probe through the lower hole in the center casting left rear cover plate, marked 3750, and connect to the U-shaped wire directly under the hole. Remove plug-in unit to gain access to the hole.

a. Set oscilloscope (or DMM) to 1V DC range and connect X10 probe to oscilloscope input.

b. Set the 1 MHz frequency selector dial (third most significant digit, third from left) to zero for this adjustment.

c. Switch the 10 MHz frequency selector dial (second most significant digit, second from left) through positions 0-9 and observe voltage at each step.

d. Adjust the appropriate resistor on board 4800. See Figure 5-1. (Remove bottom cover and stand CE-4 on its back). The adjustable resistors are in order from back to front. Dial 0 is adjusted by resistor toward rear and dial 9 is adjusted by resistor toward front.

e. Adjust each dial position for a reading of -0.4V on the DMM. Voltage may be between -0.2 and -0.6V but should be set to -0.4V as closely as possible. Disconnect probe.

Step Attenuator

5.13 Set monitor frequency to 150 MHz, FUNCTION to SIG GEN CW, Step Attenuator to +40 dB and Variable Attenuator full clockwise.

a. Connect a DC Voltmeter to the AGC output of a VHF/UHF receiver.

CAUTION

A poor VSRW in the receiver can cause large errors.

b. Connect the 20 dB fixed attenuator between the receiver and the 0-1000 MHz output connector of the CE-4. Tune receiver to signal.

c. Note the signal level as indicated

by the reading on the DC voltmeter connected to the receiver. Make certain that the receiver is not saturated. (20-50μV input to receiver).

d. Switch the CE-4 Step Attenuator to +20 dB. Remove the 20 dB fixed attenuator and connect the receiver to CE-4 output. Adjust R40 (marked 20S) on the 3100 board for the same level reading as noted in step c.

e. Reset CE-4 step attenuator to +40 dB, insert the 40 dB fixed attenuator between the CE-4 output and the receiver. Note the signal level as indicated by the reading on the voltmeter connected to the receiver.

f. Set the CE-4 step attenuator to 0 dB. Remove the 40 dB fixed attenuator and connect receiver to CE-4 output. Adjust R37 (marked 40S) on the 3100 board for the same level reading as noted in step e.

Output Power Calibration

5.14 Set the CE-4 Monitor Frequency to 150 MHz, FUNCTION switch to SIG GEN CW, Step Attenuator to +40 dB, Variable Attenuator to -107 dBm.

a. Set the Signal Generator (HP 8640) for 150 MHz and -27 dBm output. Connect it to the Power Meter and note the meter reading.

b. Connect the Power Meter to the 0-1000 MHz output connector on the CE-4, using 40 dB fixed attenuator. Adjust R26 (marked CA) on the 3100 board for the same meter reading as noted in step a.

Time Base Calibration

5.15 Set the CE-4 Monitor Frequency to 900.0000 MHz, FUNCTION switch to SIG GEN, Step Attenuator to +40 dB, Variable Attenuator to -107 dBm.

a. Connect wideband amplifier (900 MHz, 26 dB) to CE-4 0-1000 MHz output. Connect counter to amplifier output.

b. Set counter for 900 MHz input and observe frequency counted.

c. Using a non-metallic adjusting tool, adjust the trimmer in the crystal oscillator enclosure mounted on chassis just behind left plug-in tray until the counter display reads 900,000,000 ± 20 Hz. Remove counter and amplifier.

Frequency Meter Calibration

5.16 Set the CE-4 Monitor FUNCTION switch to SIG GEN. Set CAL control to 12 o'clock position. Set meter range switch to 1.5 kHz.

a. Turn off the CE-4 and mechanically adjust the FREQUENCY error meter to center zero. Place the 4600 board on extender.

b. Turn on the CE-4 and adjust R53 on the 4600 board (see component identification drawing on Figure 6-22) for a zero reading on the FREQUENCY error meter. Turn off CE-4 and replace 4600 board.

c. Turn on CE-4. Set FUNCTION switch to SIG GEN FM. Set FM CAL control to 2 o'clock position. Adjust L2 on 4400 board (see component identification drawing on Figure 6-21) for a zero reading on the FREQUENCY error meter.

d. Set the CE-4 frequency to 50.0550 MHz, set FUNCTION switch to MONITOR, set FREQUENCY meter range switch to 1.5 kHz.

e. Set the signal generator (HP 8640B) to 50.055 MHz and lock at this frequency. Connect signal generator to the input of the RF plug-in in the Wide Band mode. Set plug-in SENSITIVITY to WIDE. Adjust signal generator output until the CE-4 SIGNAL LEVEL light comes on.

f. Set FREQUENCY meter on the CE-4 to zero with the CAL control.

g. Set the CE-4 frequency dials to the following frequencies and the FREQUENCY meter range switch to the following settings: Adjust the indicated control on board 4400 for a full scale reading, either plus or minus, for each range. (The signal generator must be left at the locked frequency, 50.055 MHz). The first setting gives the minus full scale reading and the second the plus full scale reading.

CE-4 Frequency	Meter Range Switch	Adjustment Control
50.0565	1.5 kHz	R4405, marked 1.5 kHz, adjust for (-) full scale
50.0535	1.5 kHz	Check for (+) full scale ± 0.5 div.
50.0600	5.0 kHz	R4404, marked 5 kHz, adjust for (-) full scale
50.0500	5.0 kHz	Check for (+) full scale ± 0.5 div.
50.0700	15 kHz	R4403, marked 15 kHz adjust for (-) full scale

CE-4 Frequency	Meter Range Switch	Adjustment Control
50.0400	15K	Check for (+) full scale ± 0.5 div.

TROUBLESHOOTING

5.17 Before making extensive checks of other circuits the power supply regulated outputs should be checked according to paragraph 5.10.

5.18 Check the instrument in both Monitor and Signal Generator modes to determine whether the trouble is confined to either mode. Also check to see whether it is localized in either CW, AM or FM. If another CE-4 is available, suspected boards may be substituted. In shooting trouble, use the block diagrams, Figures 4-2, 4-3 to trace signals through the instrument.

5.19 To further narrow down the area of trouble, a high frequency oscilloscope such as the HP 180 series or equivalent, or a frequency counter such as the EIP 350C or equivalent may be used for signal tracing. The frequencies and voltages into and out of the circuit boards are given in many cases on the block diagrams.

5.20 In the troubleshooting Table 5-1 some front panel indications of possible troubles are listed with the possible cause and the circuits or boards that should be checked.

5.21 If trouble is traced to the Microwave Casting it is suggested that the instrument be returned to Cushman Electronics, Customer Service for repair. See paragraph 2.05, 2.06.

Table 5-1. Troubleshooting Chart

	TROUBLE	POSSIBLE CAUSE	CHECK
1.	CE-4 inoperative	Main fuse	Check and replace if necessary.
2.	CE-4 inoperative except oven light	Fuse on power supply regulator board	Check and replace if necessary.
3.	Frequency Meter pinned, Signal Level light on	No -12V DC	Check -12V fuse on rectifier board.
4.	No RF signal reception, Signal Generation OK	RF plug-in	Check for signal through plug-in, check for proper squelch output
5.	No Signal Generation, reception OK, CAL OK	40 dB attenuator fuse	Check 40 dB attenuator
6.	No Signal Generator FM or CW, no CAL, reception OK	10 MHz modulator	Check 10 MHz outputs from 10 MHz board, 4400
7.	No CW Signal Generation, FM Sig Gen OK	No 10 MHz output from Reference Divider	Check for 10 MHz output from Reference Divider board, 2700
8.	No FM Sig Gen, CW Sig Gen OK	VCO on 10 Hz Modulator board	Check VCO output at board pin J4004-U
9.	No CAL, no SIG GEN, no reception, unlocked light on	Reference Divider board or Time Base	Check board 2700 for proper outputs and input.
10.	Frequency meter pinned in CAL or Sig Gen. SIGNAL LEVEL light on	Second IF and discriminator	Check 9.9 MHz to board 4600, check discriminator input and output.
11.	SIGNAL LEVEL light on. No RF in. Frequency meter pinned in MONITOR	RF plug-in	Squelch misadjusted.
12.	Unlocked light on, but CE-4 appears to work OK	Unlocked light logic or pulse stretcher	Check unlocked light circuits on 2500 board.

SECTION 6
PARTS LISTS AND SCHEMATIC DIAGRAMS

Parts Lists and Schematic Diagrams

6.01 The following parts lists and schematic diagrams have been arranged in order according to the Circuit Reference Series numbers. Refer to paragraphs 4.02-4.06. Each schematic diagram and parts list is identified with this number. The circuit boards in the instrument are marked with an identifying Assembly Number. The PC Board number is etched on the board. See Cross Reference Table 6-1 below.

6.02 Parts list pages are grouped with the schematic diagrams to which they refer. Component identification drawings showing the location of the individual components on the circuit board are placed on the inner sheet of the schematic diagram to which they apply.

Table 6-1. Printed Circuit Board and Circuit Reference Numbers Cross Reference

Ckt. Bd. No.	Circuit Title	Ckt. Ref. No.	Assembly No.	Fig. No.	Page No.
1780-0264	17.9-19 MHz Mixer	2400	7001-0165	6-6	6-27
1780-0271	1190-1300 MHz Phase Lock	3750	7001-0158	6-18	6-79
1780-0274	1300-2200 MHz Phase Lock	3900	7001-0160	6-20	6-91
1780-0275	Voltage Controlled Attenuator	3600	7001-0156	6-16	6-69
1780-0278	1300-2200 MHz Oscillator	3800	7001-0159	6-19	6-85
1780-0281	RF Switch	3200	7001-0401	6-13	6-57
1780-0283	Microwave Mixer	3500	7001-0155	6-15	6-65
1780-0288	Power Supply and Regulator	5100	7001-0168	6-25	6-117
1780-0297	Frequency Multiplier	2200	7001-0147	6-4	6-17
1780-0299	100 kHz Divide-by-N	2300	7001-0144	6-5	6-21
1780-0737	40 dB Attenuator	----	7001-0430	6-27	6-123
1780-0312	1000 MHz Low Pass Filter	3450	7001-0154	6-14	6-61
1780-0314	1190-1300 MHz Oscillator	3700	7001-0157	6-17	6-73
1780-0517	Attenuator Control	3100	7001-0402	6-12	6-53
1780-0523	AC Filter	5200	7001-0415	6-26	6-119
1780-0525	Second IF/Discriminator	4600	7001-0400	6-22	6-103
1780-0528	Reference Divider	2700	7001-0399	6-9	6-39
1780-0707	100 Hz VCO and Phase Detector	2800	7001-0375	6-10	6-45
1780-0708	100 Hz Divide-by-N	2600	7001-0376	6-8	6-35
1780-0709	RF Mixer	2100	7001-0377	6-3	6-11
1780-0710	10 MHz Modulator and Switch Logic	4400	7001-0442	6-21	6-97
1780-0711	Audio Amplifier and Variable Control	4800	7001-0379	6-23	6-109
1780-0712	100 kHz VCO and Phase Detector	2500	7001-0380	6-7	6-31
	Front Panel Interconnection Diagram	1000		6-1	6-3
	Microwave Casting Interconnection Diagram	3000		6-11	6-49
	Main Chassis Interconnection Diagram	2000/4000		6-2	6-7
	Rear Panel Interconnection Diagram	5000		6-24	6-113
1780-0711	Audio Amplifier and Varactor Control M10	4800-M10	7001-0416	6-29	6-131
1780-0713	Switch Mounting M10	1100-M10	7001-0382	6-28	6-125
1780-0714	Frequency Synthesizer M10	4900-M10	7001-0383	6-30	6-137
	Tone Generator Interconnection Diagram	M10		6-31	6-139
1780-0263	Wideband Amplifier Fuse Assy M11	3050-M11	7001-0455	6-32	6-143
1780-0281	RF Switch M11	3200-M11	7001-0152	6-33	6-147
1780-0516	High Level Amplifier M11	3300-M11	7001-0263	6-34	6-151

Front Panel, 1000

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
1000	Panel Assy, Front	7003-0112	Cushman	
	DIODES			
CR1	Diode, red, light emitting	1281-0113	Dialco	559-0101-001
CR2	Diode, red, light emitting	1281-0113	Dialco	559-0101-001
CR3	Diode, red, light emitting	1281-0113	Dialco	559-0101-001
	PANEL LIGHT			
DS1	Lamp, Oven On	2900-0007	Dialco	507-4537-1437-640
	CONNECTORS			
J1	Conn, BNC Jack Rect. Panel Mt.	2536-0010	Kings	KC79-35
J2	Conn, BNC Jack Rect. Panel Mt.	2536-0010	Kings	KC79-35
J3	Conn, BNC Jack Rect. Panel Mt.	2536-0010	Kings	KC79-35
	METER			
M1	Meter, Frequency w/Bezel	1402-0018	Cushman	
	RESISTORS			
R1/S2	Pot, 10K, 20%, Aud Tpr Cmrsn Dpst	1203-0084	CTS Brnsv	LM2903A FR-027-45-8D
R2	P/O S7			
R3	Pot, 1K, 500K, Linear Dual	1204-0003	Allen-Bradley	JJC91400C
R4/S12	Pot, 2.5K, 20%, 1/2W w/Spst	1203-0053	CTS Brnsv	GC321 X4P1385
R5	Res, 150 Ohm, 5%, 1/4W Comp	1066-1515	Allen-Bradley	CB1515
	SWITCHES			
S1	Switch, Rotary 2 Pole 10 Position	1851-0074	Cushman	
S2	P/O R1			
S3	Switch, Rotary 5 Pole 10 Position	1851-0101	Cushman	
S4	Switch, Toggle Spdt	1850-0008	C&K	7101
S5	Switch, Rotary 5 Pole 10 Position	1851-0075	Cushman	
S6	Switch, Lever	1851-0063	Cushman	
S7/R2	Switch, Rotary Cnctrc 4 Pl 5 Pos Pot	1851-0104	Cushman	
S8	Switch, Rotary 4 Pole 10 Position	1851-0105	Cushman	
S9	Switch, Rotary 4 Pole 10 Position	1851-0105	Cushman	
S10	Switch, Lever	1851-0063	Cushman	
S11	Switch, Rotary 4 Pole 10 Position	1851-0105	Cushman	
S12	P/O R4			
S13	Switch, Rotary 4 Pole 10 Position	1851-0105	Cushman	

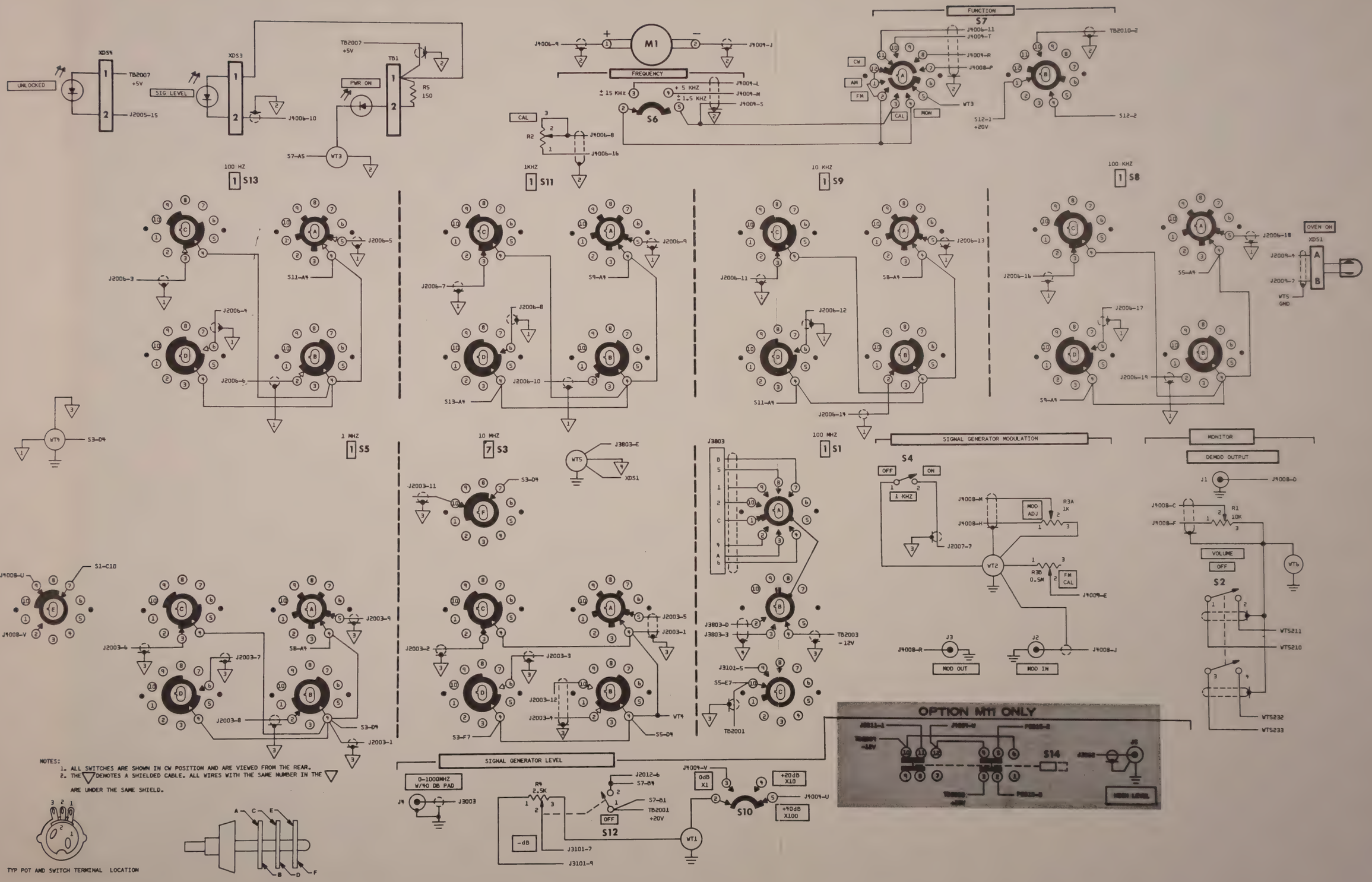
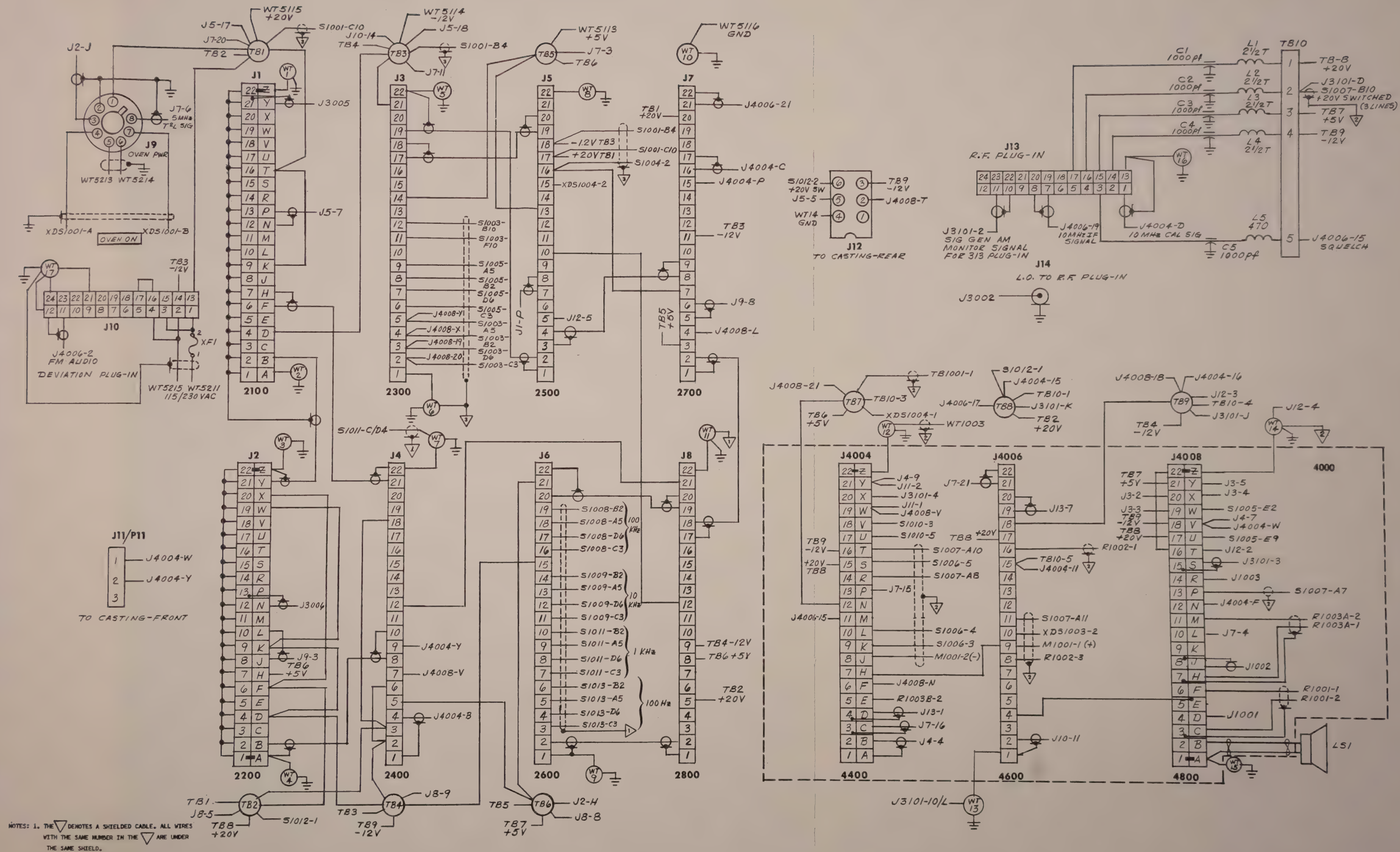


Figure 6-1. Front Panel Interconnection Diagram, 1000

Main Chassis, 2000/4000

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
2000/4000	Assy, Main Wiring	7030-0142	Cushman	
	CAPACITORS			
C4001	Cap, 1000PF, 20%, 500V Feedthru	1005-0008	Erie	357-001-X5U0-102M
C4002	Cap, 1000PF, 20%, 500V Feedthru	1005-0008	Erie	357-001-X5U0-102M
C4003	Cap, 1000PF, 20%, 500V Feedthru	1005-0008	Erie	357-001-X5U0-102M
C4004	Cap, 1000PF, 20%, 500V Feedthru	1005-0008	Erie	357-001-X5U0-102M
C4005	Cap, 1000PF, 20%, 500V Feedthru	1005-0008	Erie	357-001-X5U0-102M
	FUSE			
F2001	Fuse, 2/10 Amp	1955-0009	Bussman	MDL 2/10
	CONNECTORS			
J2001	Conn, 44 Pin Double Row Female	2535-0023	Viking	2VK22D/1-1
J2002	Conn, 44 Pin Double Row Female	2535-0023	Viking	2VK22D/1-1
J2003	Conn, 22 Pin PC Bd Female	2535-0018	Viking	2VK22S/1-1
J2004	Conn, 22 Pin PC Bd Female	2535-0018	Viking	2VK22S/1-1
J2005	Conn, 22 Pin PC Bd Female	2535-0018	Viking	2VK22S/1-1
J2006	Conn, 22 Pin PC Bd Female	2535-0018	Viking	2VK22S/1-1
J2007	Conn, 22 Pin PC Bd Female	2535-0018	Viking	2VK22S/1-1
J2008	Conn, 22 Pin PC Bd Female	2535-0018	Viking	2VK22S/1-1
J2009	Socket, Octal	2605-0001	Cinch Jones	8 EM
J2010	Conn, 24 Pin Female	2535-0020	Amphenol	25-190-24
J2011	Conn, 3 Pin Mini Receptacle Housing	2535-0035	Molex	03-06-1032
J2012	Conn, 6 Pin Mini Receptacle Housing	2535-0049	Molex	R03-06-1061
J2013	Conn, 24 Pin Female	2535-0020	Amphenol	25-190-24
J2014	Conn, BNC Push On	2536-0039	Specialty Co.	28JS140-3
J4001	Not Used			
J4002	Not Used			
J4003	Not Used			
J4004	Conn, 44 Pin Double Row Female	2535-0023	Viking	2VK22D/1-1
J4005	Not Used			
J4006	Conn, 22 Pin PC Bd Female	2535-0018	Viking	2VK22S/1-1
J4007	Not Used			
J4008	Conn, 44 Pin Double Row Female	2535-0023	Viking	2VK22D/1-1
	INDUCTORS			
L4001	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L4002	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L4003	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L4004	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L4005	Choke, 470μH, 5%	1585-0019	Delevan	2500-12
	SPEAKER			
LS2001	Speaker	1715-0003	Quam	74-6248
	CRYSTAL			
Y2001	Osc, Ovenized, 5 MHz	2001-0002	Cushman	



NOTES: 1. THE ▽ DENOTES A SHIELDED CABLE. ALL WIRES WITH THE SAME NUMBER IN THE ▽ ARE UNDER THE SAME SHIELD.

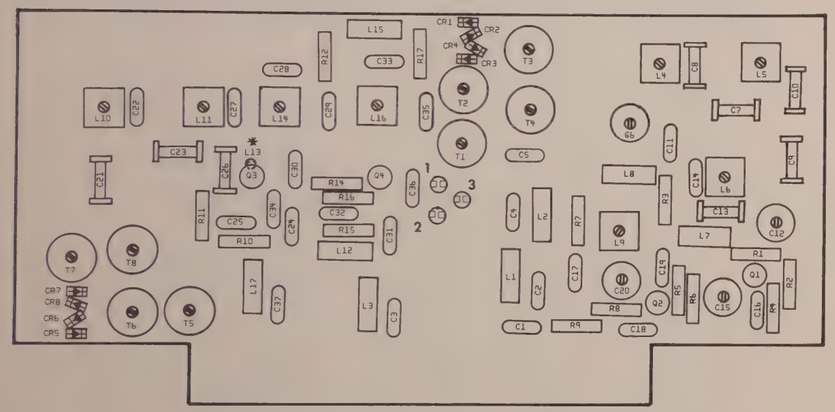
Figure 6-2. Main Chassis Interconnection Diagram, 2000/4000

R. F. Mixers, 2100

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
2100	PCB Assy, RF Mixers	7001-0377	Cushman	
	PC Board	1780-0709	Cushman	
	CAPACITORS			
C1	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C2	Cap, 100PF, 5%, 500V Mica	1002-0011	Elmenco	DM15-F-101J
C3	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C4	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C5	Cap, 100PF, 5%, 500V Mica	1002-0011	Elmenco	DM15-F-101J
C6	Cap, 2-8PF, 350V Vert Trim	1001-0004	Erie	538-002A-2-8-89A
C7	Cap, 1.5PF, .25PF%, 500V Tub.	1005-0041	Erie	301-000-C0K0-159C
C8	Cap, 12PF, 5%, 500V Mica	1002-0017	Elmenco	DM15-C-120J
C9	Cap, 1.5PF, .25PF%, 500V Tub.	1005-0041	Erie	301-000-C0K0-159C
C10	Cap, 15PF, 5%, 500V Tub.	1005-0010	Erie	301-000-C0G0-150J
C11	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C12	Cap, 2-8PF, 350V Vert Trim	1001-0004	Erie	538-002A-2-8-89A
C13	Cap, 15PF, 5%, 500V Tub.	1005-0010	Erie	301-000-C0G0-150J
C14	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C15	Cap, 9-35PF, 200V Vert Trim	1001-0006	Erie	538-002-94D
C16	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C17	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C18	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C19	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C20	Cap, 5.5-18PF, 350V Vert Trim	1001-0008	Erie	538-002A-5.5-18
C21	Cap, 3.3PF, .25PF%, 500V Tub.	1005-0011	Erie	301-000-C0J0-339C
C22	Cap, 10PF, 5%, 500V Mica	1002-0016	Elmenco	DM15-C-100J
C23	Cap, .68PF, .25PF%, 500V Tub.	1005-0039	Erie	301-000-C0K0-688C
C24	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C25	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C26	Cap, 3.3PF, .25PF%, 500V Tub.	1005-0011	Erie	301-000-C0J0-339C
C27	Cap, 10PF, 5%, 500V Mica	1002-0016	Elmenco	DM15-C-100J
C28	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C29	Cap, 24PF, 500V Mica	1002-0051	Elmenco	DM15-C-240J
C30	Cap, 5PF, .5PF%, 500V Mica	1002-0028	Elmenco	DM15-C-050D
C31	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C32	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C33	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C34	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C35	Cap, 24PF, 5%, 500V Mica	1002-0051	Elmenco	DM15-C-240J
C36	Cap, 5PF, .5PF%, 500V Mica	1002-0028	Elmenco	DM15-C-050D
C37	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
	DIODES			
CR1	Diode, HPA2800	1283-0001	HPA	5082-2800
CR2	Diode, HPA2800	1283-0001	HPA	5082-2800
CR3	Diode, HPA2800	1283-0001	HPA	5082-2800
CR4	Diode, HPA2800	1283-0001	HPA	5082-2800
CR5	Diode, HPA2800	1283-0001	HPA	5082-2800
CR6	Diode, HPA2800	1283-0001	HPA	5082-2800
CR7	Diode, HPA2800	1283-0001	HPA	5082-2800
CR8	Diode, HPA2800	1283-0001	HPA	5082-2800

R. F. Mixers, 2100 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	INDUCTORS			
L1	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L2	Choke, .33μH, 5%	1585-0052	Delevan	1535-04
L3	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L4	Assy, Coil Variable 3 1/4 Turn	1596-0052	Cushman	
L5	Assy, Coil Variable 3 1/4 Turn	1596-0052	Cushman	
L6	Assy, Coil Variable 3 1/3 Turn	1596-0052	Cushman	
L7	Choke, .15μH, 20%	1585-0048	Delevan	1537-00
L8	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L9	Assy, Coil Variable 4 3/4 Turn	1596-0062	Cushman	
L10	Assy, Coil Variable 3 1/4 Turn	1596-0052	Cushman	
L11	Assy, Coil Variable 3 1/4 Turn	1596-0052	Cushman	
L12	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L13	Choke, U-250 Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L14	Assy, Coil Variable 1 3/4 Turn	1596-0051	Cushman	
L15	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L16	Assy, Coil Variable 1 3/4 Turn	1596-0051	Cushman	
L17	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
	TRANSISTORS			
Q1	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q2	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q3	Trans, 2N4121	1272-0023	Fairchild	2N4121
Q4	Trans, 2N4121	1272-0023	Fairchild	2N4121
	RESISTORS			
R1	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R2	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R3	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R4	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R5	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R6	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R7	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R8	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R9	Res, 51 Ohm, 5%, 1/4W Comp	1066-5105	Allen-Bradley	CB5105
R10	Res, 1.8K, 5%, 1/4W Comp	1066-1825	Allen-Bradley	CB1825
R11	Res, 4.7K, 5%, 1/4W Comp	1066-4725	Allen-Bradley	CB4725
R12	Res, 1.5K, 5%, 1/4W Comp	1066-1525	Allen-Bradley	CB1525
R13	Not Used			
R14	Res, 4.7 Ohm, 5%, 1/4W Comp	1066-0001	Ohmite	
R15	Res, 1.8K, 5%, 1/4W Comp	1066-1825	Allen-Bradley	CB1825
R16	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R17	Res, 1.2K, 5%, 1/4W Comp	1066-1225	Allen-Bradley	CB1225
	TRANSFORMERS			
T1	Assy, Transformer Bifilar Toroidal	1579-0025	Cushman	
T2	Assy, Trifilar Coil	1579-0017	Cushman	
T3	Assy, Trifilar Coil	1579-0017	Cushman	
T4	Assy, Transformer Bifilar Toroidal	1579-0025	Cushman	
T5	Assy, Transformer Bifilar Toroidal	1579-0025	Cushman	
T6	Assy, Trifilar Coil	1579-0017	Cushman	
T7	Assy, Trifilar Coil	1579-0017	Cushman	
T8	Assy, Transformer Bifilar Toroidal	1579-0025	Cushman	



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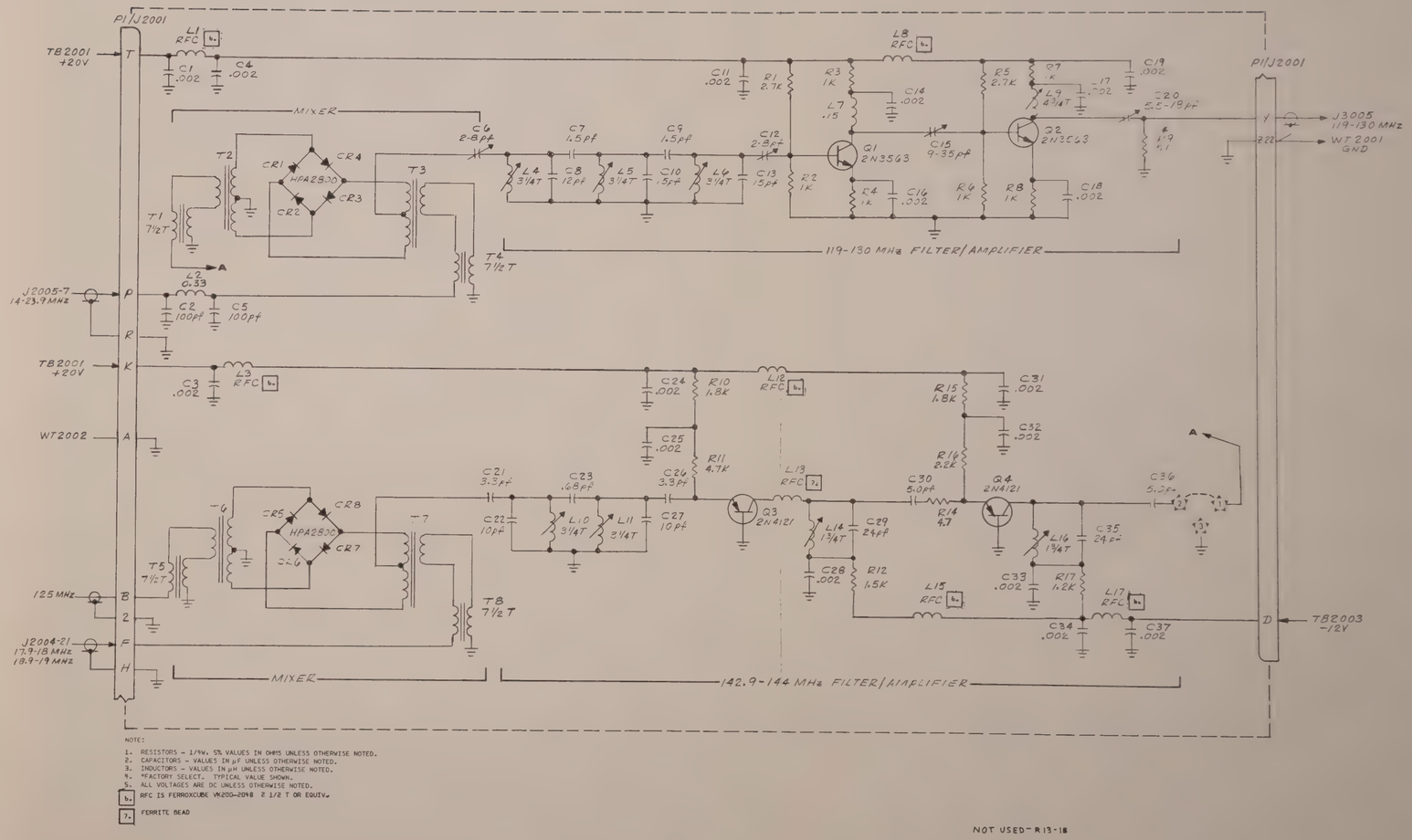


5601**0065**2

Figure 6-3. R. F. Mixers, 2100

Frequency Multiplier, 2200

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
2200	Assy, Multiplier Frequency	7001-0147	Cushman	
	PC Board	1780-0297	Cushman	
	CAPACITORS			
C1	Cap, 100PF, 5%, 500V Mica	1002-0011	Elmenco	DM15-F-101J
C2	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C3	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C4	Cap, 30PF, 5%, 500V Mica	1004-0010	Cornell-Dub.	CD10ED300J
C5	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C6	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C7	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C8	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C9	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C10	Not Used			
C11	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C12	Not Used			
C13	Cap, 390PF, 5%, 100V Mica	1004-0017	Cornell-Dub.	CD10FA391J
C14	Cap, 240PF, 5%, 500V Mica	1002-0030	Elmenco	DM15-F-241J
C15	Cap, 10PF, 5%, 500V Mica	1002-0016	Elmenco	DM15-C-100J
C16	Cap, 51PF, 5%, 500V Mica	1004-0012	Cornell-Dub.	CD10ED510J
C17	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C18	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C19	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C20	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C21	Cap, 10PF, 5%, 500V Mica	1002-0016	Elmenco	DM15-C-100J
C22	Cap, 240PF, 5%, 500V Mica	1004-0015	Cornell-Dub.	CD10FD241J
C23	Cap, 10PF, ±5%, 500V Mica	1002-0016	Elmenco	DM15-C-100J
C24	Cap, 390PF, 5%, 100V Mica	1004-0017	Cornell-Dub.	CD10FA391J
C25	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C26	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C27	Cap, 15PF, 5%, 500V Mica	1002-0001	Elmenco	DM15-C-150J
C28	Cap, 240PF, 5%, 500V Mica	1004-0015	Cornell-Dub.	CD10FD241J
C29	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C30	Cap, 27PF, 5%, 500V Mica	1004-0009	Cornell-Dub.	CD10ED270J
C31	Cap, 390PF, 5%, 100V Mica	1004-0017	Cornell-Dub.	CD10FA391J
C32	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C33	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C34	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C35	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C36	Cap, 240PF, 5%, 500V Mica	1004-0015	Cornell-Dub.	CD10FD241J
C37	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C38	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C39	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C40	Cap, 22PF, 5%, 500V Mica	1002-0023	Elmenco	DM15-C-220J
C41	Cap, 22PF, 5%, 500V Mica	1002-0023	Elmenco	DM15-C-220J
C42	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C43	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C44	Cap, 2.2PF, .25PF%, 500V Tub.	1005-0017	Erie	301-000-C0J0-229C
C45	Cap, 30PF, 5%, 500V Mica	1004-0010	Cornell-Dub.	CD10ED300J
C46	Cap, 2.2PF, .25PF%, 500V Tub.	1005-0017	Erie	301-000-C0J0-229C
C47	Cap, 15PF, 5%, 500V Mica	1002-0001	Elmenco	DM15-C-150J
C48	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C49	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C50	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M

Frequency Multiplier, 2200 (cont)

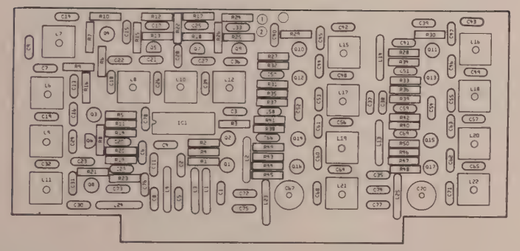
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
C51	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C52	Cap, 2.2PF, .25PF%, 500V Tub.	1005-0017	Erie	301-000-C0J0-229C
C53	Cap, 30PF, 5%, 500V Mica	1004-0010	Cornell-Dub.	CD10ED300J
C54	Cap, 2.2PF, .25PF%, 500V Tub.	1005-0017	Cornell-Dub.	CD10FA391J
C55	Cap, 20PF, 5%, 500V Mica	1004-0008	Cornell-Dub.	CD10ED200J
C56	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C57	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C58	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C59	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C60	Cap, 3.3PF, .25PF%, 500V Tub.	1005-0011	Erie	301-000-COJO-339C
C61	Cap, 30PF, 5%, 500V Mica	1004-0010	Cornell-Dub.	CD10ED300J
C62	Cap, 3.3PF, .25PF%, 500V Tub.	1005-0011	Erie	301-000-COJO-339C
C63	Cap, 20PF, 5%, 500V Mica	1004-0008	Cornell-Dub.	CD10ED200J
C64	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C65	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C66	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C67	Cap, 2-8PF, 350V Vert Trim	1001-0004	Erie	538-002A-2-8-89A
C68	Cap, 30PF, 5%, 500V Mica	1004-0010	Cornell-Dub.	CD10ED300J
C69	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z4U-202M
C70	Cap, 2-8PF, 350V Vert Trim	1001-0004	Erie	538-002A-2-8-89A
C71	Cap, 20PF, 5%, 500V Mica	1004-0008	Cornell-Dub.	CD-10ED200J
C72	Cap, 27PF, 5%, 500V Mica	1004-0009	Cornell-Dub.	CD-10ED270J
C73	Cap, 270PF, 5%, 300V Mica	1004-0016	Cornell-Dub.	CD10FC271J
C74	Cap, 27PF, 5%, 500V Mica	1004-0009	Cornell-Dub.	CD10ED270J
C75	Cap, 68PF, 5%, 500V Mica	1004-0014	Cornell-Dub.	CD10ED680J
C76	Cap, 270PF, 5%, 300V Mica	1004-0016	Cornell-Dub.	CD10FC271J
C77	Cap, 56PF, 5%, 500V Mica	1004-0013	Cornell-Dub.	CD10ED560J
C78	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
	INDUCTORS			
L1	Choke, 180μH, 5%	1585-0035	Delevan	1537-88
L2	Choke, 180μH, 5%	1585-0035	Delevan	1537-88
L3	Choke, 180μH, 5%	1585-0035	Delevan	1537-88
L4	Choke, 15μH, 10%	1585-0034	Delevan	1537-40
L5	Not Used			
L6	Coil, 4 Turn 31 MHz	1596-0110	Cushman	
L7	Coil, 4 Turn 31 MHz	1596-0110	Cushman	
L8	Coil, 4 Turn 31 MHz	1596-0110	Cushman	
L9	Coil, 4 Turn 31 MHz	1596-0110	Cushman	
L10	Coil, 4 Turn 31 MHz	1596-0110	Cushman	
L11	Coil, 4 Turn 31 MHz	1596-0110	Cushman	
L12	Coil, 4 Turn 31 MHz	1596-0110	Cushman	
L13	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L14	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L15	Coil Assy, Variable	7050-0122	Cushman	
L16	Coil Assy, Variable	7050-0122	Cushman	
L17	Coil Assy, Variable	7050-0122	Cushman	
L18	Coil Assy, Variable	7050-0122	Cushman	
L19	Coil Assy, Variable	7050-0122	Cushman	
L20	Coil Assy, Variable	7050-0122	Cushman	
L21	Coil Assy, Variable	7050-0122	Cushman	
L22	Coil Assy, Variable	7050-0122	Cushman	
L23	Coil Assy, .08μH	1596-5702	Cushman	
L24	Choke, .56μH, 10%	1585-0036	Delevan	1840-07
L25	Assy, Coil, .06μH	1596-5701	Cushman	

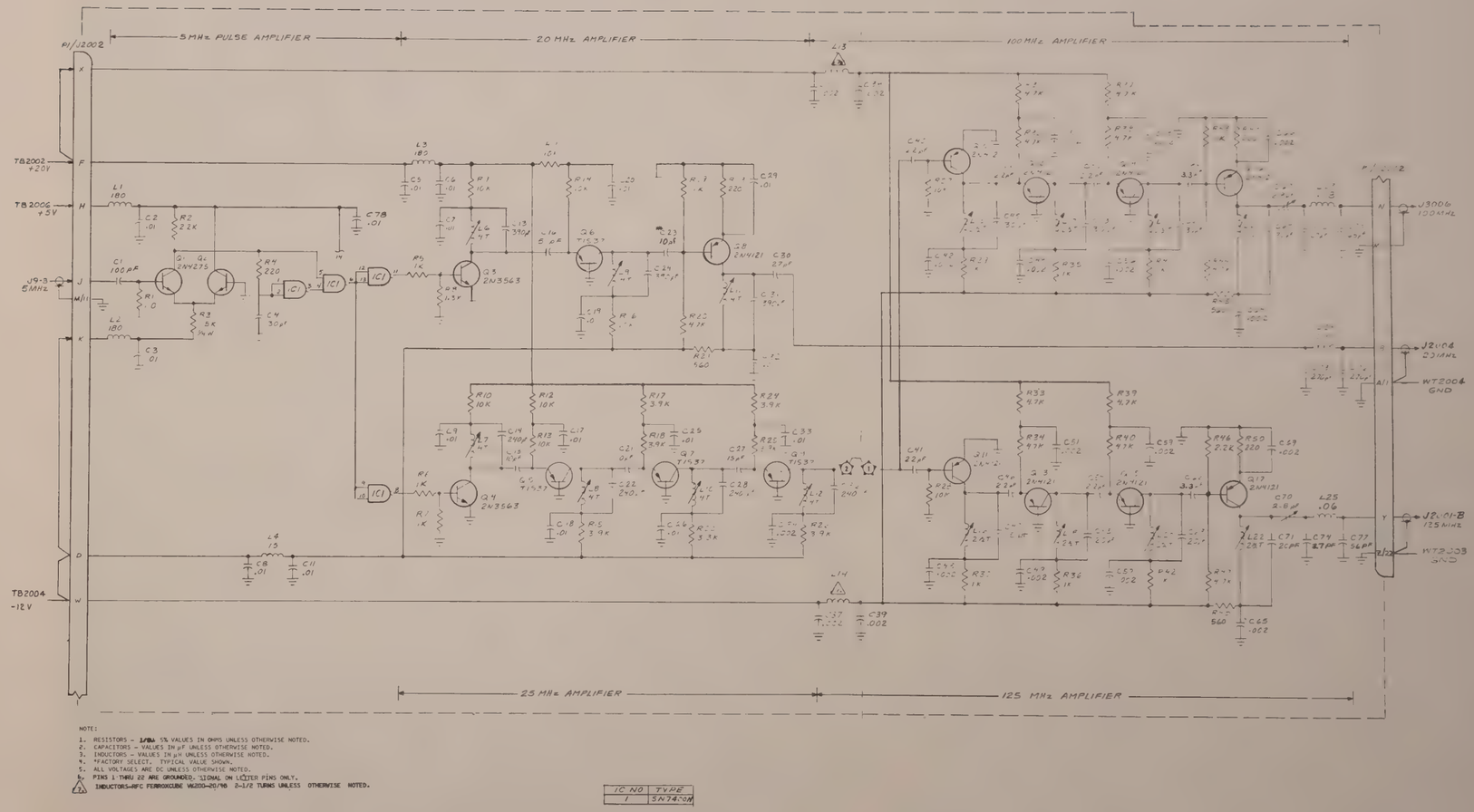
Frequency Multiplier, 2200 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	TRANSISTORS			
Q1	Trans, 2N4275	1272-0016	Fairchild	2N4275
Q2	Trans, 2N4275	1272-0016	Fairchild	2N4275
Q3	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q4	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q5	Trans, TIS 37	1271-0003	TI	TIS 37
Q6	Trans, TIS 37	1271-0003	TI	TIS 37
Q7	Trans, TIS 37	1271-0003	TI	TIS 37
Q8	Trans, 2N4121	1272-0023	Fairchild	2N4121
Q9	Trans, TIS 37	1271-0003	TI	TIS 37
Q10	Trans, 2N4121	1272-0023	Fairchild	2N4121
Q11	Trans, 2N4121	1272-0023	Fairchild	2N4121
Q12	Trans, 2N4121	1272-0023	Fairchild	2N4121
Q13	Trans, 2N4121	1272-0023	Fairchild	2N4121
Q14	Trans, 2N4121	1272-0023	Fairchild	2N4121
Q15	Trans, 2N4121	1272-0023	Fairchild	2N4121
Q16	Trans, 2N4121	1272-0023	Fairchild	2N4121
Q17	Trans, 2N4121	1272-0023	Fairchild	2N4121
	RESISTORS			
R1	Res, 110 Ohm, 5%, 1/8W Comp	1065-1115	Allen-Bradley	BB1115
R2	Res, 2.2K, 5%, 1/8W Comp	1065-2225	Allen-Bradley	BB2225
R3	Res, 1.5K, 5%, 1/4W Comp	1066-1525	Allen-Bradley	CB1525
R4	Res, 220 Ohm, 5%, 1/8W Comp	1065-2215	Allen-Bradley	BB2215
R5	Res, 1K, 5%, 1/8W Comp	1065-1025	Allen-Bradley	BB1025
R6	Res, 1K, 5%, 1/8W Comp	1065-1025	Allen-Bradley	BB1025
R7	Res, 1K, 5%, 1/8W Comp	1065-1025	Allen-Bradley	BB1025
R8	Res, 1.3K, 5%, 1/8W Comp	1065-1325	Allen-Bradley	BB1325
R9	Res, 10K, 5%, 1/8W Comp	1065-1035	Allen-Bradley	BB1035
R10	Res, 10K, 5%, 1/8W Comp	1065-1035	Allen-Bradley	BB1035
R11	Res, 10K, 5%, 1/8W Comp	1065-1035	Allen-Bradley	BB1035
R12	Res, 10K, 5%, 1/8W Comp	1065-1035	Allen-Bradley	BB1035
R13	Res, 10K, 5%, 1/8W Comp	1065-1035	Allen-Bradley	BB1035
R14	Res, 10K, 5%, 1/8W Comp	1065-1035	Allen-Bradley	BB1035
R15	Res, 3.9K, 5%, 1/8W Comp	1065-3925	Allen-Bradley	BB3925
R16	Res, 10K, 5%, 1/8W Comp	1065-1035	Allen-Bradley	BB1035
R17	Res, 3.9K, 5%, 1/8W Comp	1065-3925	Allen-Bradley	BB3925
R18	Res, 3.9K, 5%, 1/8W Comp	1065-3925	Allen-Bradley	BB3925
R19	Res, 1K, 5%, 1/8W Comp	1065-1025	Allen-Bradley	BB1025
R20	Res, 4.7K, 5%, 1/8W Comp	1065-4725	Allen-Bradley	BB4725
R21	Res, 560 Ohm, 5%, 1/8W Comp	1065-5615	Allen-Bradley	BB5615
R22	Res, 3.3K, 5%, 1/8W Comp	1065-3325	Allen-Bradley	BB3325
R23	Res, 220 Ohm, 5%, 1/8W Comp	1065-2215	Allen-Bradley	BB2215
R24	Res, 3.9K, 5%, 1/8W Comp	1065-3925	Allen-Bradley	BB3925
R25	Res, 3.9K, 5%, 1/8W Comp	1065-3925	Allen-Bradley	BB3925
R26	Res, 3.9K, 5%, 1/8W Comp	1065-3925	Allen-Bradley	BB3925
R27	Res, 10K, 5%, 1/8W Comp	1065-1035	Allen-Bradley	BB1035
R28	Res, 10K, 5%, 1/8W Comp	1065-1035	Allen-Bradley	BB1035
R29	Res, 1K, 5%, 1/8W Comp	1065-1025	Allen-Bradley	BB1025
R30	Res, 1K, 5%, 1/8W Comp	1065-1025	Allen-Bradley	BB1025

Frequecy Multiplier, 2200 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R31	Res, 4.7K, 5%, 1/8W Comp	1065-4725	Allen-Bradley	BB4725
R32	Res, 4.7K, 5%, 1/8W Comp	1065-4725	Allen-Bradley	BB4725
R33	Res, 4.7K, 5%, 1/8W Comp	1065-4725	Allen-Bradley	BB4725
R34	Res, 4.7K, 5%, 1/8W Comp	1065-4725	Allen-Bradley	BB4725
R35	Res, 1K, 5%, 1/8W Comp	1065-1025	Allen-Bradley	BB1025
R36	Res, 1K, 5%, 1/8W Comp	1065-1025	Allen-Bradley	BB1025
R37	Res, 4.7K, 5%, 1/8W Comp	1065-4725	Allen-Bradley	BB4725
R38	Res, 4.7K, 5%, 1/8W Comp	1065-4725	Allen-Bradley	BB4725
R39	Res, 4.7K, 5%, 1/8W Comp	1065-4725	Allen-Bradley	BB4725
R40	Res, 4.7K, 5%, 1/8W Comp	1065-4725	Allen-Bradley	BB4725
R41	Res, 1K, 5%, 1/8W Comp	1065-1025	Allen-Bradley	BB1025
R42	Res, 1K, 5%, 1/8W Comp	1065-1025	Allen-Bradley	BB1025
R43	Res, 1K, 5%, 1/8W Comp	1065-1025	Allen-Bradley	BB1025
R44	Res, 4.7K, 5%, 1/8W Comp	1065-4725	Allen-Bradley	BB4725
R45	Res, 560 Ohm, 5%, 1/8W Comp	1065-5615	Allen-Bradley	BB5615
R46	Res, 2.2K, 5%, 1/8W Comp	1065-2225	Allen-Bradley	BB2225
R47	Res, 4.7K, 5%, 1/8W Comp	1065-4725	Allen-Bradley	BB4725
R48	Res, 560 Ohm, 5%, 1/8W Comp	1065-5615	Allen-Bradley	BB5615
R49	Res, 220 Ohm, 5%, 1/8W Comp	1065-2215	Allen-Bradley	BB2215
R50	Res, 220 Ohm, 5%, 1/8W Comp	1065-2215	Allen-Bradley	BB2215
	INTEGRATED CIRCUIT			
U1	IC, SN7400N TTL Nand Gates	2025-0003	TI	SN7400N





NOTE:
1. RESISTORS – 1/8W 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS – VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS – VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.
6. PINS 1 THRU 22 ARE GROUNDED. ⏚ SIGNAL ON LETTER PINS ONLY.
⚠1 INDUCTORS-#8FC FERROXCUBE VK200-20/4B 2-1/2 TURNS UNLESS OTHERWISE NOTED.

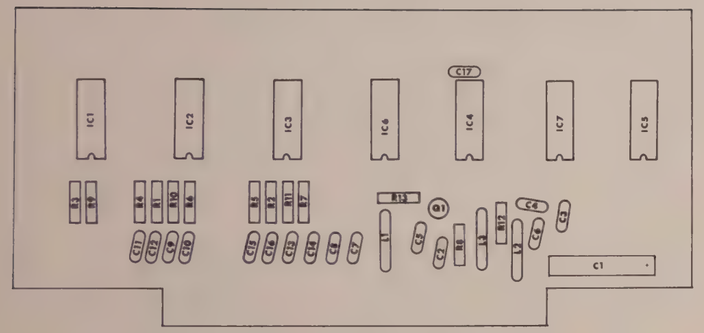
IC NO	TYPE
1	SN74-00N

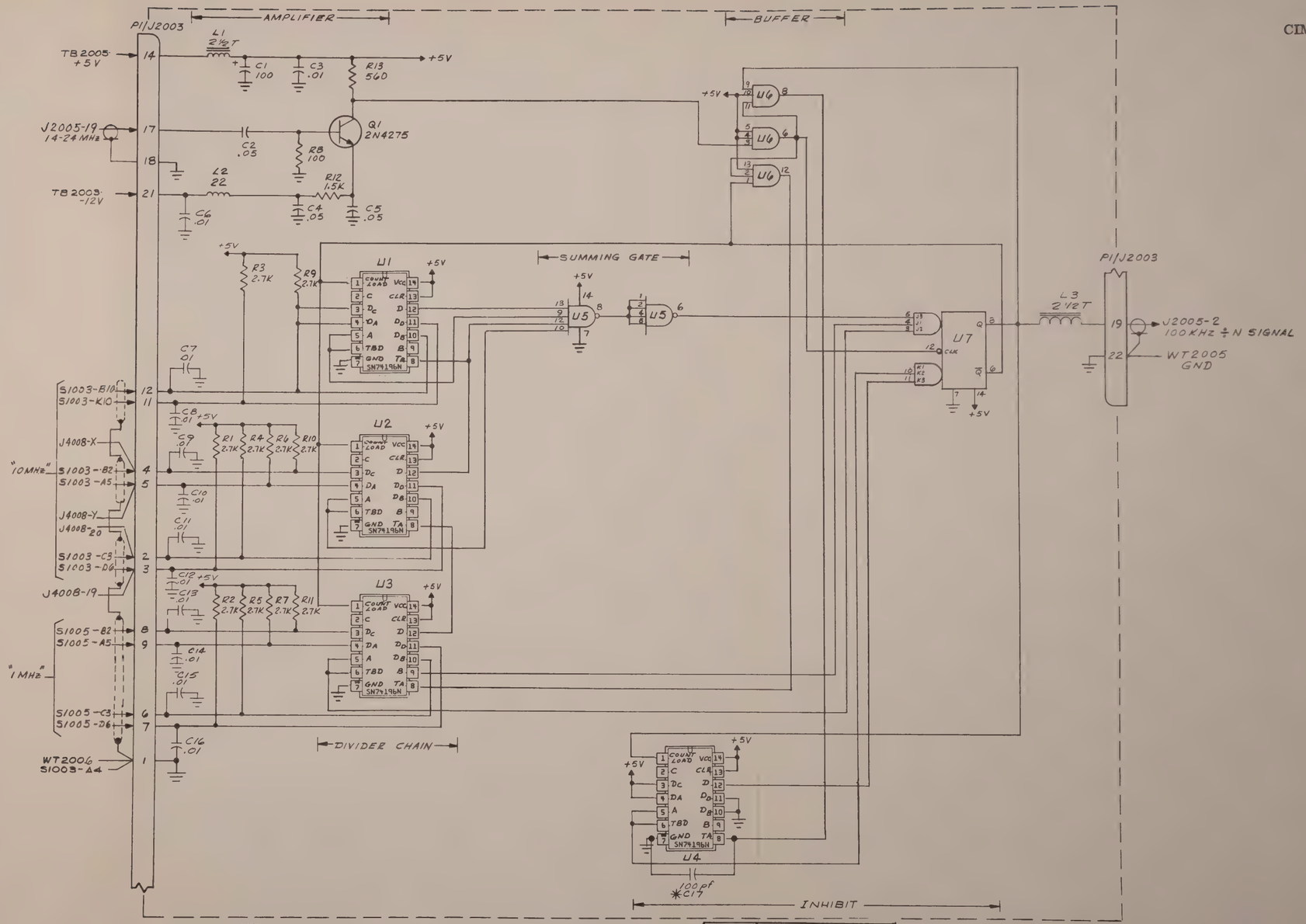
Figure 6-4. Frequency Multiplier, 2200

5601**0065**2

100 kHz Divide-By-N, 2300

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
2300	Assy, Divide-by-N, 100 kHz	7001-0144	Cushman	
	PC Board	1780-0299	Cushman	
	CAPACITORS			
C1	Cap, 100μF, 10%, 25V, Elect	1013-0003	Sprague	30D107G025DD5
C2	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C3	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C4	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C5	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C6	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C7	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C8	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C9	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C10	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C11	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C12	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C13	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C14	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C15	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C16	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C17	Cap, 100PF, 5%, 100V, Min Cer	1005-0082	Erie	8121-100-C0G-101K
	INDUCTORS			
L1	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L2	Choke, 22μH, 10%	1585-0012	Delevan	1537-44
L3	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
	TRANSISTOR			
Q1	Trans, 2N4275	1272-0016	Fairchild	2N4275
	RESISTORS			
R1	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R2	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R3	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R4	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R5	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R6	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R7	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R8	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R9	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R10	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R11	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R12	Res, 1.5K, 5%, 1/4W Comp	1066-1525	Allen-Bradley	CB1525
R13	Res, 560 Ohm, 5%, 1/4W Comp	1066-5615	Allen-Bradley	CB5615
	INTEGRATED CIRCUITS			
U1	IC, SN74196N	2025-0016	TI	SN74196N
U2	IC, SN74196N	2025-0016	TI	SN74196N
U3	IC, SN74196N	2025-0016	TI	SN74196N
U4	IC, SN74196N	2025-0016	TI	SN74196N
U5	IC, SN7420N, Dual 4 Input Nand Gate	2025-0008	TI	SN7420N
U6	IC, SN74H11N, TTL and Gate	2025-0017	TI	SN74H11N
U7	IC, SN74H72N	2025-0023	TI	SN74H72N





NOTE:

1. RESISTORS – 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS – VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS – VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

U NO.	TYPE	VCC	GND
1,2,3,4	SN74196N	14	7
5	SN7420N	14	7
6	SN74H11N	14	7
7	SN74H72N	14	7

5601**0065

Figure 6-5. 100 kHz Divide-By-N, 2300

6-21/6-22

17.9 MHz-19 MHz Mixer, 2400

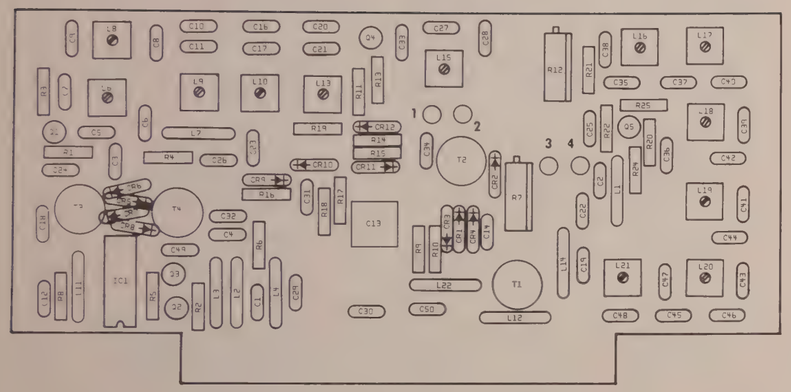
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
2400	Assy, PC Bd. Mixer 17.9-19 MHz	7001-0165	Cushman	
	PC Board	1780-0264	Cushman	
	CAPACITORS			
C1	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C2	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C3	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C4	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C5	Cap, 100PF, 5%, 500V Mica	1002-0011	Elmenco	DM15-F-101J
C6	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C7	Cap, 15PF, 5%, 500V Mica	1002-0001	Elmenco	DM15-C-150J
C8	Cap, 2.2PF, .25PF%, 500V Tub.	1005-0017	Erie	301-000-C0J0-229C
C9	Cap, 96PF, 1%, 500V Mica	1002-0049	Elmenco	DM15-F-960F
C10	Cap, 1.5PF, .25PF%, 500V Tub.	1005-0041	Erie	301-000-C0K0-159C
C11	Cap, 110PF, 5%, 500V Mica	1002-0026	Elmenco	DM15-F-111J
C12	Cap, 330PF, 5%, 500V Mica	1002-0032	Elmenco	DM15-F-331J
C13	Cap, 2-8PF, 350V Horiz. Trim	1001-0010	Erie	538-006A(2-8)
C14	Cap, 5PF, .5PF%, 500V Mica	1002-0028	Elmenco	DM15-C-050D
C15	Not Used			
C16	Cap, 2.2PF, .25PF%, 500V Tub.	1005-0017	Erie	301-000-C0J0-229C
C17	Cap, 110PF, 5%, 500V Mica	1002-0026	Elmenco	DM15-F-111J
C18	Cap, .0022μF, 10%, 100V	1008-0020	Sprague	225P22291WA3
C19	Cap, 220PF, 5%, 500V Mica	1002-0029	Elmenco	DM15-F-221J
C20	Cap, 15PF, 5%, 500V Mica	1002-0001	Elmenco	DM15-C-150J
C21	Cap, 96PF, 1%, 500V Mica	1002-0049	Elmenco	DM15-F-960F
C22	Cap, 180PF, 5%, 500V Mica	1002-0005	Elmenco	DM15-F-181J
C23	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C24	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C25	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C26	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C27	Cap, 100PF, 5%, 500V Mica	1002-0011	Elmenco	DM15-F-101J
C28	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C29	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C30	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C31	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C32	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C33	Cap, 20PF, 5%, 500V Mica	1002-0060	Elmenco	DM15-E-200J
C34	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C35	Cap, 100PF, 5%, 500V Mica	1002-0011	Elmenco	DM15-F-101J
C36	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C37	Cap, 15PF, 5%, 500V Mica	1002-0001	Elmenco	DM15-C-150J
C38	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C39	Cap, 10PF, 5%, 500V Mica	1002-0016	Elmenco	DM15-C-100J
C40	Cap, 96PF, 1%, 500V Mica	1002-0049	Elmenco	DM15-F-960F
C41	Cap, 8.2PF, .25PF%, 500V Tub.	1005-0043	Erie	301-000-C0H0-829C
C42	Cap, 120PF, 5%, 500V Mica	1002-0010	Elmenco	DM15-F-121J
C43	Cap, 8.2PF, .25PF%, 500V Tub.	1005-0043	Erie	301-000-C0H0-829C
C44	Cap, 120PF, 5%, 500V Mica	1002-0010	Elmenco	DM15-F-121J
C45	Cap, 10PF, 5%, 500V Mica	1002-0016	Elmenco	DM15-C-100J
C46	Cap, 120PF, 5%, 500V Mica	1002-0010	Elmenco	DM15-F-121J
C47	Cap, 96PF, 1%, 500V Mica	1002-0049	Elmenco	DM15-F-960F
C48	Cap, 39PF, 5%, 500V Mica	1002-0018	Elmenco	DM15-E-390J
C49	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C50	Cap, 270PF, 5%, 500V Mica	1002-0031	Elmenco	DM15-F-271J

17.9 MHz-19 MHz Mixer, 2400 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	DIODES			
CR1	Diode, HPA2800	1283-0001	HP	5082-2800
CR2	Diode, HPA2800	1283-0001	HP	5082-2800
CR3	Diode, HPA2800	1283-0001	HP	5082-2800
CR4	Diode, HPA2800	1283-0001	HP	5082-2800
CR5	Diode, HPA2800	1283-0001	HP	5082-2800
CR6	Diode, HPA2800	1283-0001	HP	5082-2800
CR7	Diode, HPA2800	1283-0001	HP	5082-2800
CR8	Diode, HPA2800	1283-0001	HP	5082-2800
CR9	Diode, G633	1282-0005	ITT	G633
CR10	Diode, G633	1282-0005	ITT	G633
CR11	Diode, G633	1282-0005	ITT	G633
CR12	Diode, G633	1282-0005	ITT	G633
	INDUCTORS			
L1	Choke, 22μH, 10%	1585-0012	Delevan	1537-44
L2	Choke, 22μH, 10%	1585-0012	Delevan	1537-44
L3	Choke, 22μH, 10%	1585-0012	Delevan	1537-44
L4	Choke, 22μH, 10%	1585-0012	Delevan	1537-44
L5	Not Used			
L6	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L7	Choke, 22μH, 10%	1585-0012	Delevan	1537-44
L8	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L9	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L10	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L11	Choke, 120μH, 5%	1585-0033	Delevan	1537-80
L12	Choke, 1μH, 10%	1585-0027	Delevan	1537-12
L13	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L14	Choke, 1μH, 10%	1585-0027	Delevan	1537-12
L15	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L16	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L17	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L18	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L19	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L20	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L21	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L22	Choke, 22μH, 10%	1585-0012	Delevan	1537-44
	TRANSISTORS			
Q1	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q2	Trans, 2N4275	1272-0016	Fairchild	2N4275
Q3	Trans, 2N4275	1272-0016	Fairchild	2N4275
Q4	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q5	Trans, 2N3563	1272-0022	Fairchild	2N3563
	RESISTORS			
R1	Res, 1.8K, 5%, 1/4W Comp	1066-1825	Allen-Bradley	CB1825
R2	Res, 120 Ohm, 5%, 1/4W Comp	1066-1215	Allen-Bradley	CB1215
R3	Res, 47 Ohm, 5%, 1/4W Comp	1066-4705	Allen-Bradley	CB4705
R4	Res, 1.5K, 5%, 1/4W Comp	1066-1525	Allen-Bradley	CB1525
R5	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225

17.9 MHz-19 MHz Mixer, 2400 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R6	Res, 1.5K, 5%, 1/4W Comp	1066-1525	Allen-Bradley	CB1525
R7	Pot, 100 Ohm, 10%, 3/4W	1215-0010	Helitrim	89WR
R8	Res, 560 Ohm, 5%, 1/4W Comp	1066-5615	Allen-Bradley	CB5615
R9	Res, 51 Ohm, 5%, 1/4W Comp	1066-5105	Allen-Bradley	CB5105
R10	Res, 51 Ohm, 5%, 1/4W Comp	1066-5105	Allen-Bradley	CB5105
R11	Res, 1.8K, 5%, 1/4W Comp	1066-1825	Allen-Bradley	CB1825
R12	Pot, 100 Ohm, 10%, 3/4W	1215-0010	Helitrim	89WR
R13	Res, 47 Ohm, 5%, 1/4W Comp	1066-4705	Allen-Bradley	CB4705
R14	Res, 1.5K, 5%, 1/4W Comp	1066-1525	Allen-Bradley	CB1525
R15	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R16	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R17	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R18	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R19	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R20	Res, 4.7K, 5%, 1/4W Comp	1066-4725	Allen-Bradley	CB4725
R21	Res, 1.5K, 5%, 1/4W Comp	1066-1525	Allen-Bradley	CB1525
R22	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R23	Not Used			
R24	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R25	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
	TRANSFORMERS			
T1	Assy, Trifilar Coil	1579-0017	Cushman	
T2	Assy, Trifilar Coil	1579-0017	Cushman	
T3	Assy, Trifilar Coil	1579-0017	Cushman	
T4	Assy, Trifilar Coil	1579-0017	Cushman	
	INTEGRATED CIRCUIT			
U1	IC, SN7490N	2025-0002	TI	SN7490N



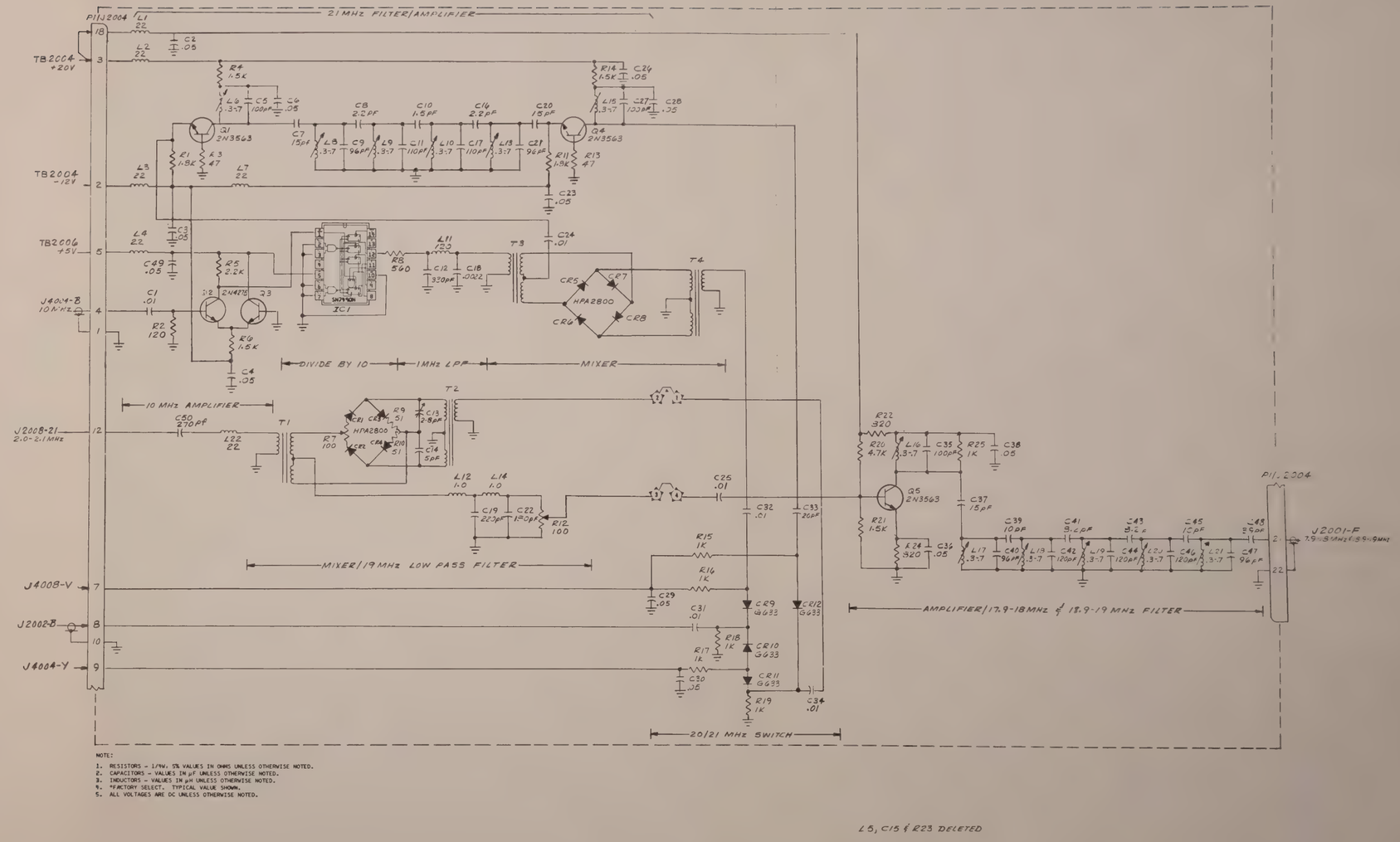


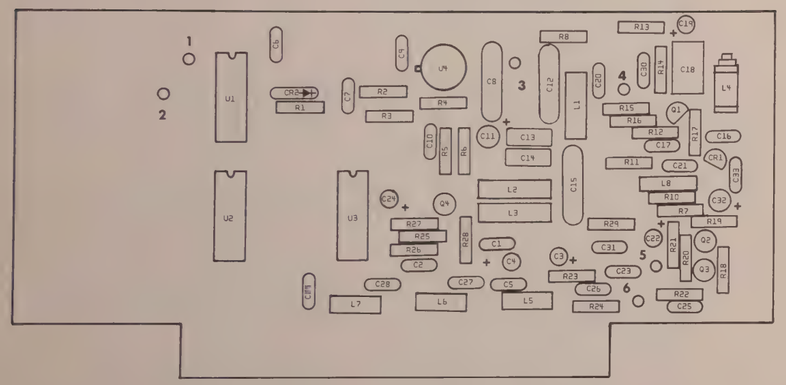
Figure 6-6. 17.9 MHz-19 MHz Mixer, 2400

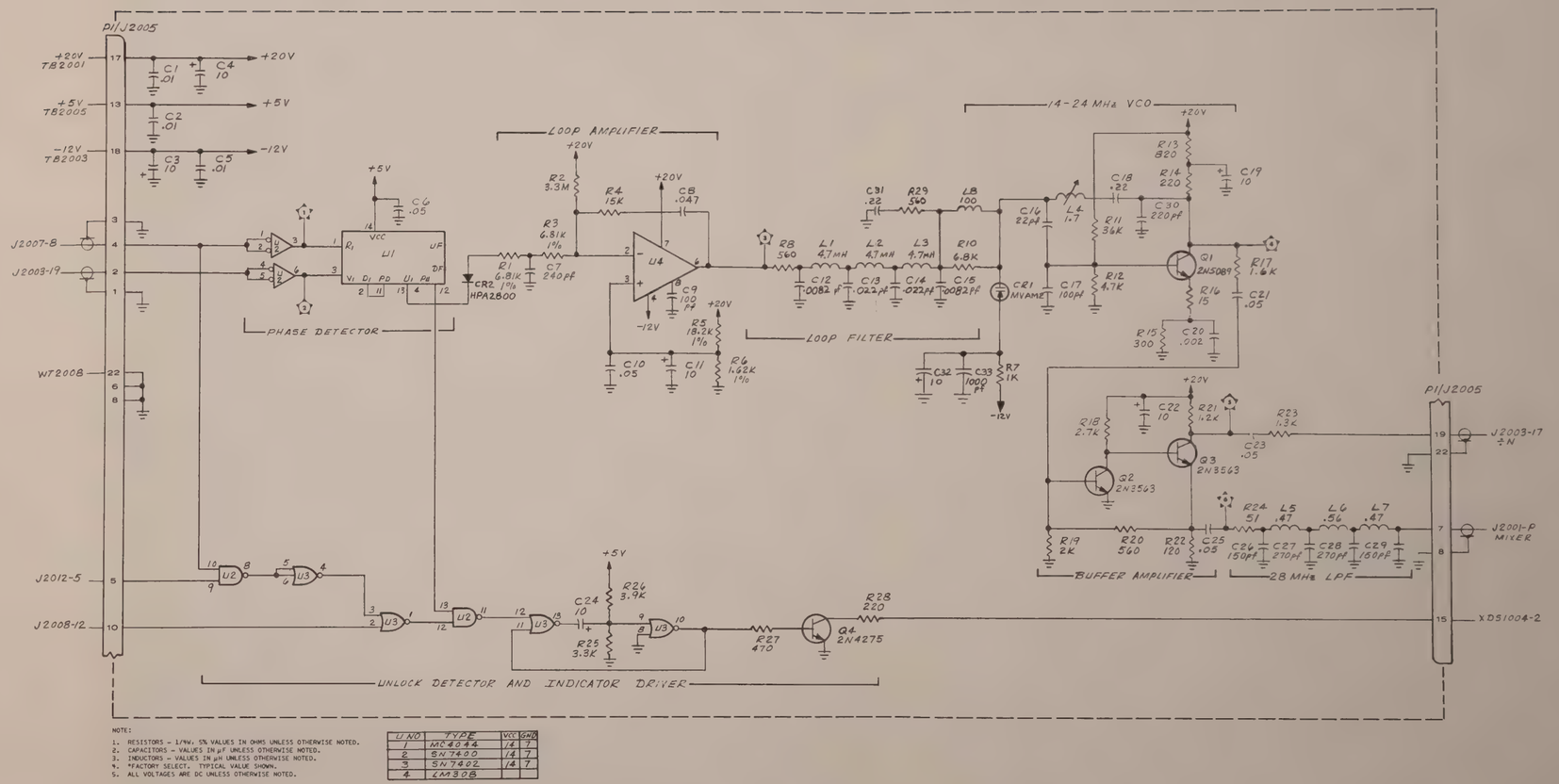
100 kHz VCO and Phase Detector, 2500

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
2500	PCB Assy - 100 kHz VCO & Phase Det	7001-0380	Cushman	
	PC Board	1780-0712	Cushman	
	CAPACITORS			
C1	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C2	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C3	Cap, 10μF, +50-20%, 35V	1011-0006	ITT	10/35-20
C4	Cap, 10μF, +50-20%, 35V	1011-0006	ITT	10/35-20
C5	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C6	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C7	Cap, 240PF, 5%, 500V Mica	1002-0030	Elmenco	DM15-F-241J
C8	Poly, .047μF, 10%, 100V	1008-0049	Sprague	225P47391WA3
C9	Cap, 100PF, 5%, 500V Mica	1002-0011	Elmenco	DM15-F-101J
C10	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C11	Cap, 10μF, +50-20%, 35V	1011-0006	ITT	10/35-20
C12	Cap, .0082μF, 10%, 100V	1008-0095	Plessey	60C822V630
C13	Cap, .022MF, 5%, 400V Polyester	1008-0094	Electrocube	232A1E223J
C14	Cap, .022MF, 5%, 400V Polyester	1008-0094	Electrocube	232A1E223J
C15	Cap, .0082μF, 10%, 100V	1008-0095	Plessey	60C822V630
C16	Cap, 22PF, 5%, 500V Mica	1002-0023	Elmenco	DM15-C-220J
C17	Cap, 100PF, 5%, 500V Mica	1002-0011	Elmenco	DM15-F-101J
C18	Mylar, .22μF, 10%, 100V	1008-0091	Electrocube	232A1B224K
C19	Cap, 10μF, +50-20%, 35V	1011-0006	ITT	10/35-20
C20	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-5961Z5U-202M
C21	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C22	Cap, 10μF, +50-20%, 35V	1011-0006	ITT	10/35-20
C23	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C24	Cap, 10μF, +50-20%, 35V	1011-0006	ITT	10/35-20
C25	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C26	Cap, 150PF, 5%, 500V Mica	1002-0021	Elmenco	DM15-F-151J
C27	Cap, 270PF, 5%, 500V Mica	1002-0031	Elmenco	DM15-F-271J
C28	Cap, 270PF, 5%, 500V Mica	1002-0031	Elmenco	DM15-F-271J
C29	Cap, 150PF, 5%, 500V Mica	1002-0021	Elmenco	DM15-F-151J
C30	Cap, 220PF, 5%, 500V Mica	1002-0029	Elmenco	DM15-F-221J
C31	Cap, .22μF, 10%, 100V	1008-0091	Electrocube	232A1B224K
C32	Cap, 10μF, +50-20%, 35V	1011-0006	ITT	10/35-20
C33	Cap, 1000PF, ±5%, 100V Mica	1002-0015	Elmenco	DM15-F-1025
	DIODES			
CR1	Diode, MVAM-2	1281-0120	Motorola	MVAM-2
CR2	Diode, HPA2800	1283-0001	HP	HPA5082-2800
CR3	Not used			
	INDUCTORS			
L1	CH, 4.7MH, 10%, RF Molded	1585-0082	Delevan	2307-475
L2	CH, 4.7MH, 10%, RF Molded	1585-0082	Delevan	2307-475
L3	CH, 4.7MH, 10%, RF Molded	1585-0082	Delevan	2307-475
L4	Coil, 1.4μH, 5%	1596-0045	Dale	1DH1041-27
L5	Choke, .47μH, 20%	1585-0031	Delevan	1537-06
L6	Choke, .56μH, 10%	1585-0036	Delevan	1840-07
L7	Choke, .47μH, 20%	1585-0031	Delevan	1537-06
L8	Choke, 100μH, 10%	1585-0054	Delevan	1025-68

100 kHz VCO and Phase Detector, 2500 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	TRANSISTORS			
Q1	Trans, 2N5089	1272-0031	Motorola	2N5089
Q2	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q3	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q4	Trans, 2N4275	1272-0016	Fairchild	2N4275
	RESISTORS			
R1	Res, 6.81K, 1%, 1/8W 100 PPM	1075-0140	Dale	MFF 1/8
R2	Res, 3.3M, 5%, 1/4W Comp	1066-3355	Allen-Bradley	CB3355
R3	Res, 6.81K, 1%, 1/8W 100 PPM	1075-0140	Dale	MFF 1/8
R4	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R5	Res, 18.2K, 1%, 1/8W MF	1075-0075	Dale	MFF 1/8
R6	Res, 1.62K, 1%, 1/8W MF	1075-0070	Dale	MFF 1/8
R7	Res, 1K, ±5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R8	Res, 560 Ohm, 5%, 1/4W Comp	1066-5615	Allen-Bradley	CB5615
R9	Not used			
R10	Res, 6.8K, 5%, 1/4W Comp	1066-6825	Allen-Bradley	CB6825
R11	Res, 36K, 5%, 1/4W Comp	1066-3635	Allen-Bradley	CB3635
R12	Res, 4.7K, 5%, 1/4W Comp	1066-4725	Allen-Bradley	CB4725
R13	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R14	Res, 220 Ohm, 5%, 1/4W Comp	1066-2215	Allen-Bradley	CB2215
R15	Res, 300 Ohm, 5%, 1/4W Comp	1066-3015	Allen-Bradley	CB3015
R16	Res, 15 Ohm, 5%, 1/4W Comp	1066-1505	Allen-Bradley	CB1505
R17	Res, 1.6K, 5%, 1/4W Comp	1066-1625	Allen-Bradley	CB1625
R18	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R19	Res, 2K, 5%, 1/4W Comp	1066-2025	Allen-Bradley	CB2025
R20	Res, 560 Ohm, 5%, 1/4W Comp	1066-5615	Allen-Bradley	CB5615
R21	Res, 1.2K, 5%, 1/4W Comp	1066-1225	Allen-Bradley	CB1225
R22	Res, 120 Ohm, 5%, 1/4W Comp	1066-1215	Allen-Bradley	CB1215
R23	Res, 1.3K, 5%, 1/4W Comp	1066-1325	Allen-Bradley	CB1325
R24	Res, 51 Ohm, 5%, 1/4W Comp	1066-5105	Allen-Bradley	CB5105
R25	Res, 3.3K, 5%, 1/4W Comp	1066-3325	Allen-Bradley	CB3325
R26	Res, 3.9K, 5%, 1/4W Comp	1066-3925	Allen-Bradley	CB3925
R27	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R28	Res, 220 Ohm, 5%, 1/4W Comp	1066-2215	Allen-Bradley	CB2215
R29	Res, 560 Ohm, 5%, 1/4W Comp	1066-5615	Allen-Bradley	CB5615
	INTEGRATED CIRCUITS			
U1	IC, MC4044P Phase Detector	2025-0066	Motorola	MC4044P
U2	IC, SN7400N, TTL Nand Gates	2025-0003	TI	SN7400N
U3	IC, SN7402, Quad 2 Inpt Pos Nor Gate	2025-0059	TI	SN7402N
U4	IC, LM308H, 8-Pin Type Op Amp	2025-0057	National	LM308H





NOTE:
1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

U NO	TYPE	VCC	GND
1	MC4044	14	7
2	SN7400	14	7
3	SN7402	14	7
4	LM308		

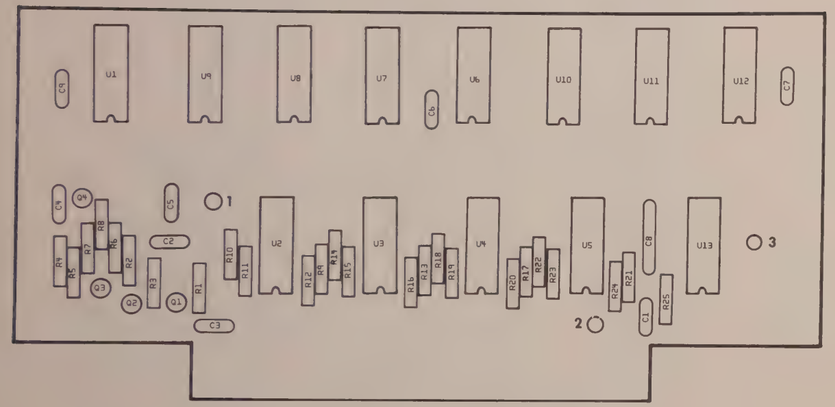
Figure 6-7. 100 kHz VCO and Phase Detector, 2500

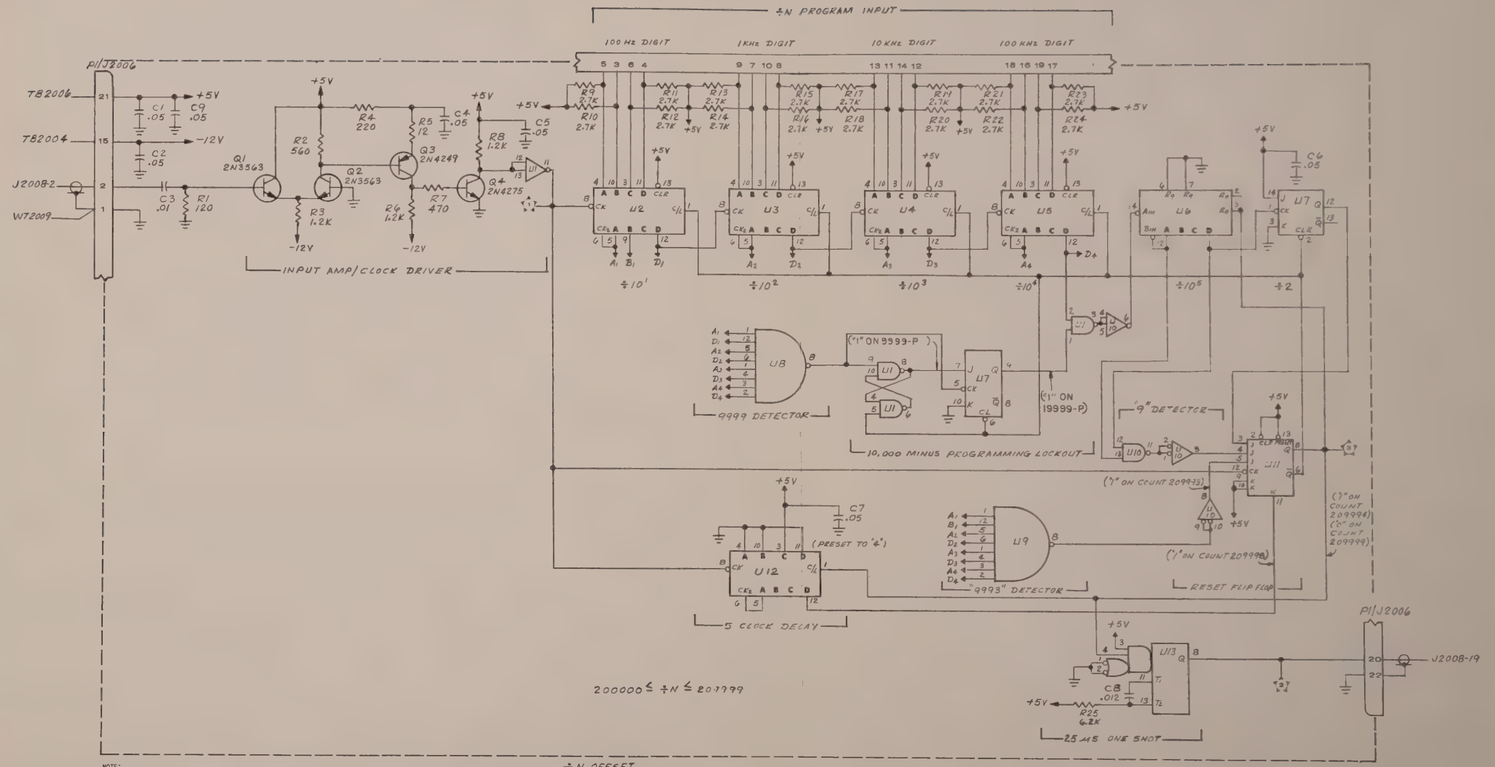
100 Hz Divide-By-N, 2600

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
2600	PCB Assy, 100 Hz Divide-by-N	7001-0376	Cushman	
	PC Board	1780-0708	Cushman	
	CAPACITORS			
C1	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C2	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C3	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C4	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C5	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C6	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C7	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C8	Cap, .012μF, 10%, 100V	1008-0040	Sprague	225P12391WA3
C9	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
	TRANSISTORS			
Q1	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q2	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q3	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q4	Trans, 2N4275	1272-0016	Fairchild	2N4275
	RESISTORS			
R1	Res, 120 Ohm, 5%, 1/4W Comp	1066-1215	Allen-Bradley	CB1215
R2	Res, 560 Ohm, 5%, 1/4W Comp	1066-5615	Allen-Bradley	CB5615
R3	Res, 1.2K, 5%, 1/4W Comp	1066-1225	Allen-Bradley	CB1225
R4	Res, 220 Ohm, 5%, 1/4W Comp	1066-2215	Allen-Bradley	CB2215
R5	Res, 12 Ohm, 5%, 1/4W Comp	1066-1205	Allen-Bradley	CB1205
R6	Res, 1.2K, 5%, 1/4W Comp	1066-1225	Allen-Bradley	CB1225
R7	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R8	Res, 1.2K, 5%, 1/4W Comp	1066-1225	Allen-Bradley	CB1225
R9	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R10	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R11	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R12	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R13	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R14	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R15	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R16	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R17	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R18	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R19	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R20	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R21	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R22	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R23	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R24	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R25	Res, 6.2K, 5%, 1/4W Comp	1066-6225	Allen-Bradley	CB6225
	INTEGRATED CIRCUITS			
U1	IC, SN7400N, TTL Nand Gates	2025-0003	TI	SN7400N
U2	IC, SN74196N	2025-0016	TI	SN74196N
U3	IC, SN74196N	2025-0016	TI	SN74196N
U4	IC, SN74196N	2025-0016	TI	SN74196N
U5	IC, SN74196N	2025-0016	TI	SN74196N

100 Hz Divide-By-N, 2600 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
U6	IC, SN7490N	2025-0002	TI	SN7490N
U7	IC, SN7473N, Dual JK Flip Flop	2025-0055	TI	SN7473N
U8	IC, SN7430A Nand Gate	2025-0004	TI	SN7430A
U9	IC, SN7430A Nand Gate	2025-0004	TI	SN7430A
U10	IC, SN7400N, TTL Nand Gates	2025-0003	TI	SN7400N
U11	IC, SN7472N, TTL Dual Flip Flop	2025-0007	TI	SN7472N
U12	IC, SN74196N	2025-0016	TI	SN74196N
U13	IC, MC8601P Monostable Multi	2025-0053	Motorola	MC8601P





NOTE:
1. RESISTORS – 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS – VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS – VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

U NO.	TYPE	VCC	GND
2,3,4,5,12	7496	14	7
8,9	7430	14	7
7	7473	4	11
11	7472	14	7
6	7490	5	10
1,10	7400	14	7
13	MC8601P	14	7

÷N OFFSET

DIAL	PROGRAM
0	9
1	8
2	7
3	6
4	5
5	4
6	3
7	2
8	1
9	0

5601••0065••2

Figure 6-8. 100 Hz Divide-By-N, 2600

Reference Divider, 2700 (cont)

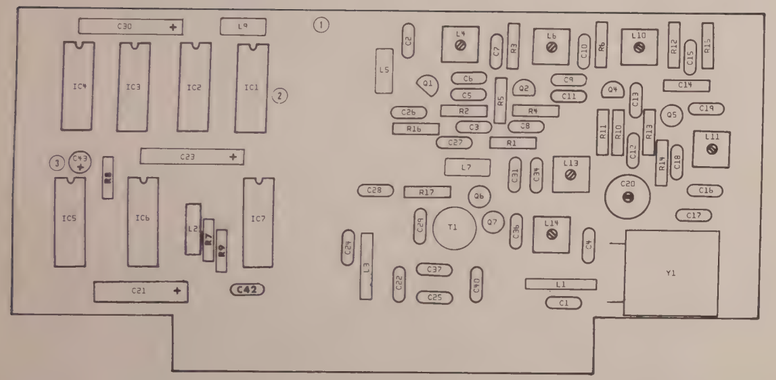
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
L6	Coil, 3.9 MHz	1596-0104	Cushman	
L7	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L8	Not Used			
L9	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L10	Coil, 3.9 MHz	1596-0104	Cushman	
L11	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L12	Not Used			
L13	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L14	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
	TRANSISTORS			
Q1	Trans, TIS 37	1271-0003	TI	TIS37
Q2	Trans, TIS 37	1271-0003	TI	TIS37
Q3	Not Used			
Q4	Trans, TIS 37	1271-0003	TI	TIS37
Q5	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q6	Trans, 2N4275	1272-0016	Fairchild	2N4275
Q7	Trans, 2N4275	1272-0016	Fairchild	2N4275
	RESISTORS			
R1	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R2	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R3	Res, 3.9K, 5%, 1/4W Comp	1066-3925	Allen-Bradley	CB3925
R4	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R5	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R6	Res, 3.9K, 5%, 1/4W Comp	1066-3925	Allen-Bradley	CB3925
R7	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R8	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R9	Res, 10 Ohm, 5%, 1/4W Comp	1066-1005	Allen-Bradley	CB1005
R10	Res, 6.8K, 5%, 1/4W Comp	1066-6825	Allen-Bradley	CB6825
R11	Res, 8.2K, 5%, 1/4W Comp	1066-8225	Allen-Bradley	CB8225
R12	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R13	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R14	Res, 3.3K, 5%, 1/4W Comp	1066-3325	Allen-Bradley	CB3325
R15	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R16	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R17	Res, 150 Ohm, 5%, 1/4W Comp	1066-1515	Allen-Bradley	CB1515
	TRANSFORMER			
T1	Assy, Trifilar Coil	1579-0017	Cushman	
	INTEGRATED CIRCUITS			
U1	IC, SN7490N	2025-0002	TI	SN7490N
U2	IC, SN7490N	2025-0002	TI	SN7490N
U3	IC, SN7400N, TTL Nand Gates	2025-0003	TI	SN7400N
U4	IC, SN7490N	2025-0002	TI	SN7490N
U5	IC, SN7490N	2025-0002	TI	SN7490N
U6	IC, SN7400N, TTL Nand Gates	2025-0003	TI	SN7400N
U7	IC, SN7400N, TTL Nand Gates	2025-0003	TI	SN7400N
	CRYSTAL			
Y1	Xtal, 9900.000 kHz Metal	2035-0004	Cushman	

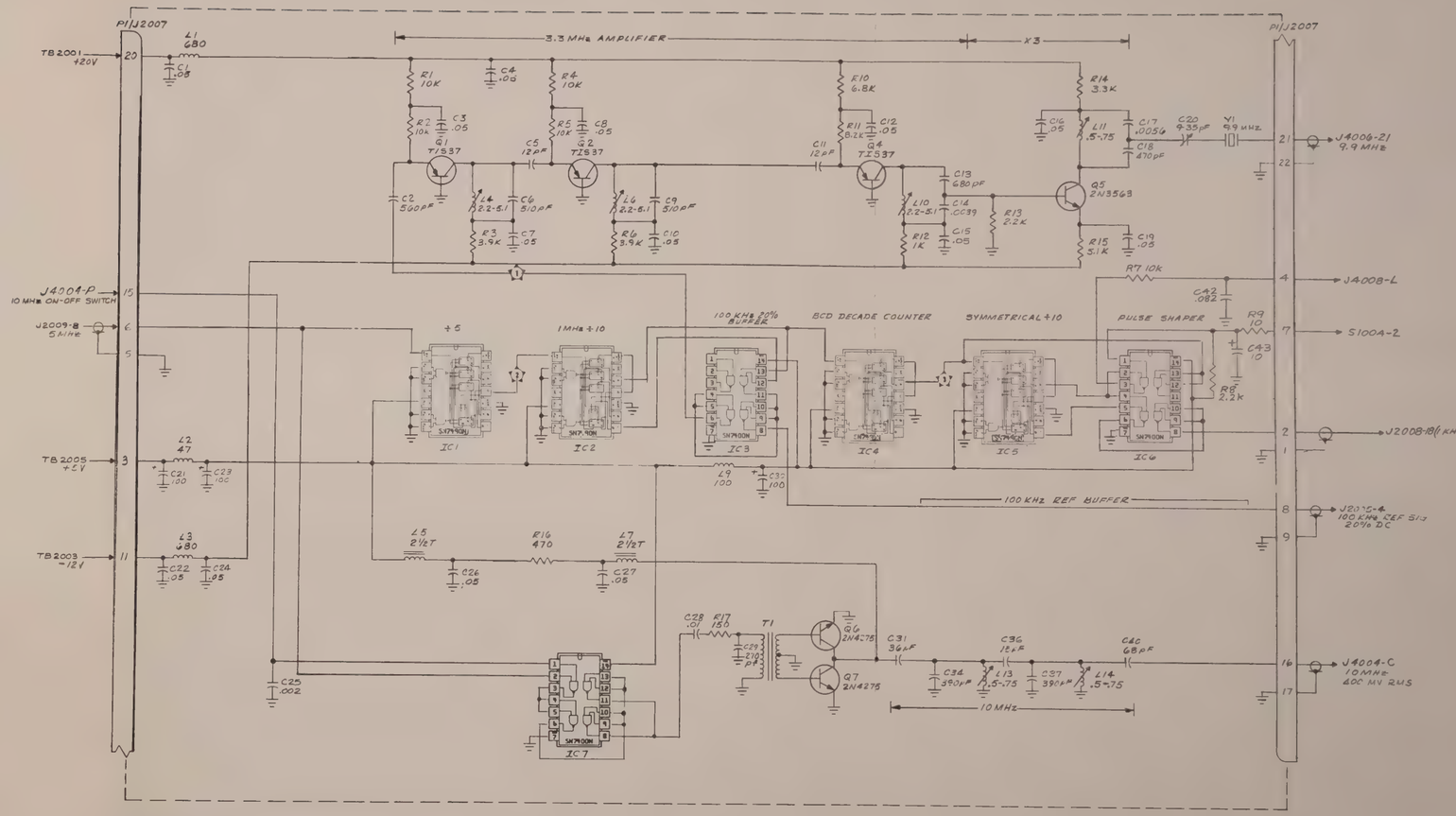
Reference Divider, 2700

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
2700	PCB Assy, Reference Divider	7001-0399	Cushman	
	PC Board	1780-0528	Cushman	
	CAPACITORS			
C1	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C2	Cap, 560PF, 5%, 300V Mica	1002-0037	Elmenco	DM15-F-561J
C3	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C4	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C5	Cap, 12PF, 5%, 500V Mica	1002-0017	Elmenco	DM15-C-120J
C6	Cap, 510PF, 5%, 500V Mica	1002-0036	Elmenco	DM15-F-511J
C7	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C8	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C9	Cap, 510PF, 5%, 500V Mica	1002-0036	Elmenco	DM15-F-511J
C10	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C11	Cap, 12PF, 5%, 500V Mica	1002-0017	Elmenco	DM15-C-120J
C12	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C13	Cap, 680PF, 5%, 300V Mica	1002-0022	Elmenco	DM15-F-681J
C14	Cap, .0039μF, 10%, 100V	1008-0052	Sprague	225P39291WD3
C15	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C16	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C17	Cap, .0056μF, 10%, 100V	1008-0022	Sprague	225P56291WA3
C18	Cap, 470PF, 5%, 500V Mica	1002-0035	Elmenco	DM15-F-471J
C19	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C20	Cap, 9-35PF, 200V Vert Trim	1001-0006	Erie	538-002-94D
C21	Cap, 100μF, +75-10%, 12V	1013-0011	Sprague	30D107G012CC5
C22	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C23	Cap, 100μF, +75-10%, 12V	1013-0011	Sprague	30D107G012CC5
C24	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U-503Z
C25	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C26	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C27	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C28	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C29	Cap, 270PF, 5%, 500V Mica	1002-0031	Elmenco	DM15-F-271J
C30	Cap, 100μF, +75-10%, 12V	1013-0011	Sprague	30D107G012CC5
C31	Cap, 36PF, 5%, 500V Mica	1002-0041	Elmenco	DM15-E-360J
C32	Not Used			
C33	Not Used			
C34	Cap, 390PF, 5%, 500V Mica	1002-0033	Elmenco	DM15-F-391J
C35	Not Used			
C36	Cap, 15PF, 5%, 500V Mica	1002-0001	Elmenco	DM15-C-150J
C37	Cap, 390PF, 5%, 500V Mica	1002-0033	Elmenco	DM15-F-391J
C38	Not Used			
C39	Not Used			
C40	Cap, 68PF, 5%, 500V Mica	1002-0013	Elmenco	DM15-E-680J
C41	Not Used			
C42	Cap, .082μF, 10%, 100V	1008-0023	Sprague	225P82391WA3
C43	Cap, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
	INDUCTORS			
L1	Choke, 68μH, 5%	1585-0023	Delevan	2500-20
L2	Choke, 47μH, 5%	1585-0010	Delevan	1537-60
L3	Choke, 680μH, 5%	1585-0023	Delevan	2500-20
L4	Coil, 3.9 MHz	1596-0104	Cushman	
L5	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B

Reference Divider, 2700 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
L6	Coil, 3.9 MHz	1596-0104	Cushman	
L7	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L8	Not Used			
L9	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L10	Coil, 3.9 MHz	1596-0104	Cushman	
L11	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L12	Not Used			
L13	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L14	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
	TRANSISTORS			
Q1	Trans, TIS 37	1271-0003	TI	TIS37
Q2	Trans, TIS 37	1271-0003	TI	TIS37
Q3	Not Used			
Q4	Trans, TIS 37	1271-0003	TI	TIS37
Q5	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q6	Trans, 2N4275	1272-0016	Fairchild	2N4275
Q7	Trans, 2N4275	1272-0016	Fairchild	2N4275
	RESISTORS			
R1	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R2	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R3	Res, 3.9K, 5%, 1/4W Comp	1066-3925	Allen-Bradley	CB3925
R4	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R5	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R6	Res, 3.9K, 5%, 1/4W Comp	1066-3925	Allen-Bradley	CB3925
R7	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R8	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R9	Res, 10 Ohm, 5%, 1/4W Comp	1066-1005	Allen-Bradley	CB1005
R10	Res, 6.8K, 5%, 1/4W Comp	1066-6825	Allen-Bradley	CB6825
R11	Res, 8.2K, 5%, 1/4W Comp	1066-8225	Allen-Bradley	CB8225
R12	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R13	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R14	Res, 3.3K, 5%, 1/4W Comp	1066-3325	Allen-Bradley	CB3325
R15	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R16	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R17	Res, 150 Ohm, 5%, 1/4W Comp	1066-1515	Allen-Bradley	CB1515
	TRANSFORMER			
T1	Assy, Trifilar Coil	1579-0017	Cushman	
	INTEGRATED CIRCUITS			
U1	IC, SN7490N	2025-0002	TI	SN7490N
U2	IC, SN7490N	2025-0002	TI	SN7490N
U3	IC, SN7400N, TTL Nand Gates	2025-0003	TI	SN7400N
U4	IC, SN7490N	2025-0002	TI	SN7490N
U5	IC, SN7490N	2025-0002	TI	SN7490N
U6	IC, SN7400N, TTL Nand Gates	2025-0003	TI	SN7400N
U7	IC, SN7400N, TTL Nand Gates	2025-0003	TI	SN7400N
	CRYSTAL			
Y1	Xtal, 9900.000 kHz Metal	2035-0004	Cushman	





NOTE:

1. RESISTORS – 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS – VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS – VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

NOT USED

C32, 33, 35, 38, 39, 41
L8, 12
Q8, 9
R18, 19, 20, 21, 22, 23

Figure 6-9. Reference Divider, 2700

5601**0065

100 Hz VCO and Phase Detector, 2800

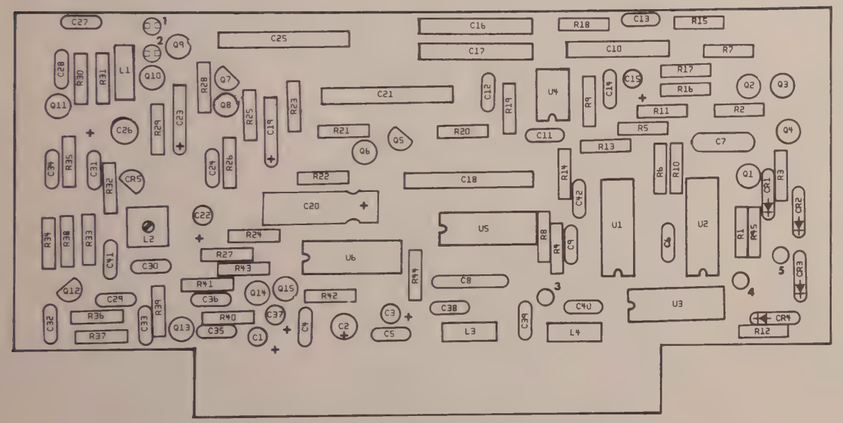
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
2800	PCB Assy - 100 Hz VCO & Phase Det	7001-0375	Cushman	
	PC Board	1780-0707	Cushman	
	CAPACITORS			
C1	Cap, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C2	Cap, 47μF, 20%, 20V	1011-0009	Dickson	D47GSC20M
C3	Cap, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C4	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C5	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C6	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C7	Cap, .22MF, 10%, 100V Mylar	1008-0091	Electrocube	232A1B224K
C8	Cap, .1μF, 10%, 100V	1008-0031	Sprague	225P10491
C9	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C10	Cap, .39μF, 10%, 200V	1008-0037	Electrocube	625B1C349K2
C11	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C12	Cap, 100PF, 5%, 500V Mica	1002-0011	Elmenco	DM15-F-101J
C13	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C14	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C15	Cap, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C16	Cap, .47μF, 100V, 10% Met. Mylar	1008-0038	Electrocube	210B1A474K
C17	Cap, .47μF, 100V, 10% Met. Mylar	1008-0038	Electrocube	210B1A474K
C18	Cap, 1.0μF, 10%, 100V	1008-0033	TRW	X663F
C19	Cap, 10μF, 10%, 20V	1011-0007	Kemet	K10C20K
C20	Cap, 100μF, +75-10%, 12V	1013-0011	Sprague	30D107G012CC5-
C21	Cap, 1.0μF, 10%, 100V	1008-0033	TRW	X663F
C22	Cap, 100μF, 20%, 20V	1011-0010	Kemet	T362D107M020AS
C23	Cap, 10μF, 10%, 20V	1011-0007	Kemet	K10C20K
C24	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C25	Cap, 1.0μF, 10%, 100V	1008-0033	TRW	X663F
C26	Cap, 100μF, 20%, 20V	1011-0010	Kemet	T362D107M020AS
C27	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C28	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C29	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C30	Cap, 220PF, 5%, 500V Mica	1002-0029	Elmenco	DM15-F-221J
C31	Cap, 15PF, 5%, 500V Mica	1002-0001	Elmenco	DM15-C-150C
C32	Cap, 220PF, 5%, 500V Mica	1002-0029	Elmenco	DM15-F-221J
C33	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C34	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C35	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C36	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C37	Cap, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C38	Cap, 220PF, 5%, 500V Mica	1002-0029	Elmenco	DM15-F-221J
C39	Cap, 240PF, 5%, 500V Mica	1002-0030	Elmenco	DM15-F-241J
C40	Cap, 820PF, 5%, 300V Mica	1002-0039	Elmenco	DM15-F-821J
C41	Cap, 36PF, 5%, 500V Mica	1002-0041	Elmenco	DM15-E-360J
C42	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
	DIODES			
CR1	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR2	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR3	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR4	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR5	Diode, MV104	1281-0058	Motorola	MV104

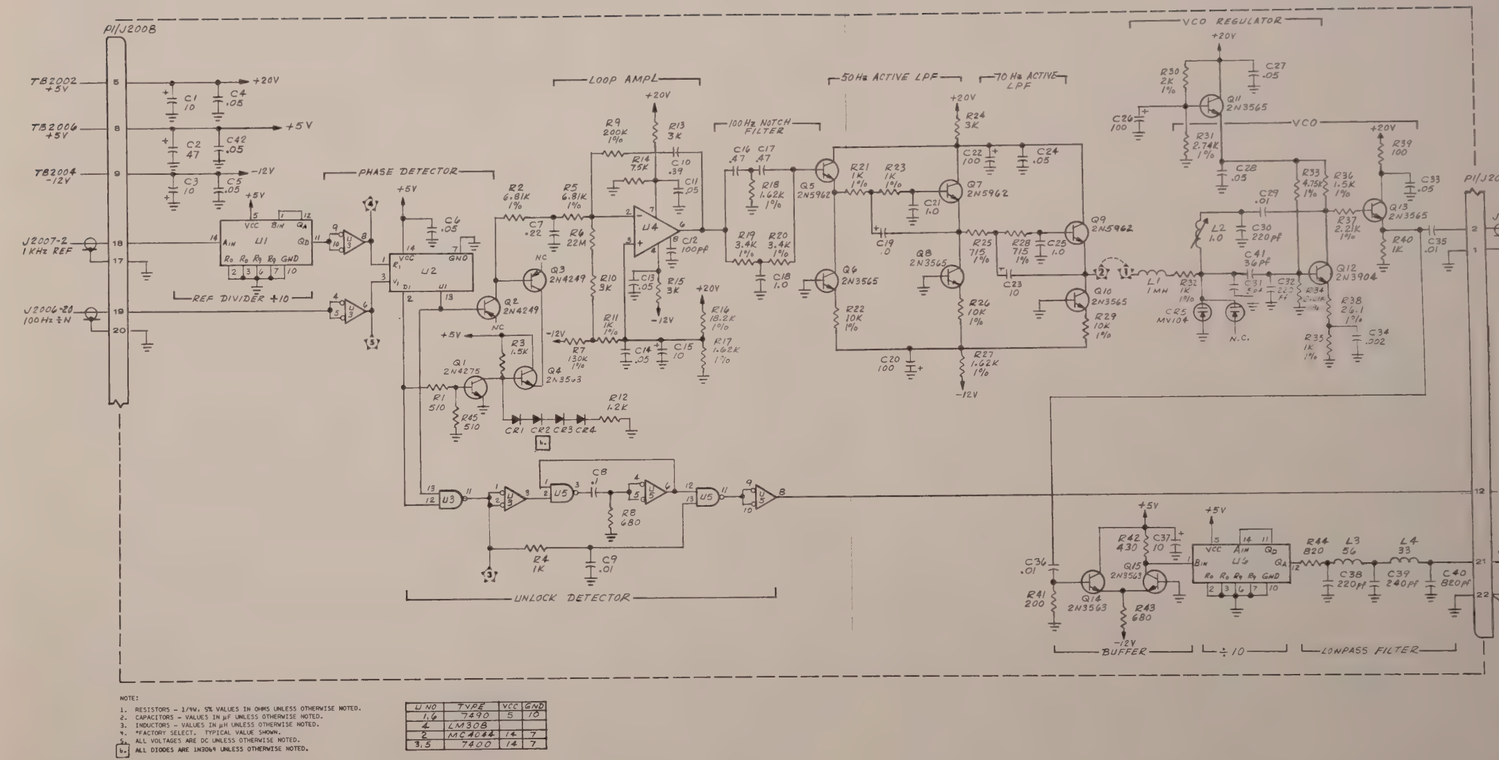
100 Hz VCO and Phase Detector, 2800 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	INDUCTORS			
L1	Choke, 1000μH, 5%	1585-0020	Delevan	2500-28
L2	Coil, Var IF .85-1.2UF	1596-0114	Cushman	
L3	Choke, 56μH, 5%, RF	1585-0042	Delevan	1537-64
L4	Choke, 33μH, 5%, RF	1585-0022	Delevan	1537-52
	TRANSISTORS			
Q1	Trans, 2N4275	1272-0016	Fairchild	2N4275
Q2	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q3	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q4	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q5	Trans, 2N5962	1272-0059	Fairchild	2N5962
Q6	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q7	Trans, 2N5962	1272-0059	Fairchild	2N5962
Q8	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q9	Trans, 2N5962	1272-0059	Fairchild	2N5962
Q10	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q11	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q12	Trans, 2N3904	1272-0032	Motorola	2N3904
Q13	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q14	Trans, 2N3563	1272-0022	Fairchild	2N3563
Q15	Trans, 2N3563	1272-0022	Fairchild	2N3563
	RESISTORS			
R1	Res, 510 Ohm, 5%, 1/4W Comp	1066-5115	Allen-Bradley	CB5115
R2	Res, 6.81K, 1%, 1/8W 100 PPM	1075-0140	Dale	MFF 1/8
R3	Res, 1.5K, 5%, 1/4W Comp	1066-1525	Allen-Bradley	CB1525
R4	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R5	Res, 6.81K, 1%, 1/8W 100 PPM	1075-0140	Dale	MFF 1/8
R6	Res, 22 Meg, 5%, 1/4W CC	1066-2265	Allen-Bradley	CB2265
R7	Res, 130K, 1%, 1/8W MF	1075-0114	Dale	MFF 1/8
R8	Res, 680 Ohm, 5%, 1/4W Comp	1066-6815	Allen-Bradley	CB6815
R9	Res, 200K, 1%, 100 PPM Film	1075-0148	Dale	MFF 1/8
R10	Res, 3K, 5%, 1/4W Comp	1066-3025	Allen-Bradley	CB3025
R11	Res, 1K, 1%, 1/8W MF	1075-0037	Dale	MFF 1/8
R12	Res, 1.2K, 5%, 1/4W Comp	1066-1225	Allen-Bradley	CB1225
R13	Res, 3K, 5%, 1/4W Comp	1066-3025	Allen-Bradley	CB3025
R14	Res, 7.5K, 5%, 1/4W Comp	1066-7525	Allen-Bradley	CB7525
R15	Res, 3K, 5%, 1/4W Comp	1066-3025	Allen-Bradley	CB3025
R16	Res, 18.2K, 1%, 1/8W MF	1075-0075	Dale	MFF 1/8
R17	Res, 1.62K, 1%, 1/8W MF	1075-0070	Dale	MFF 1/8
R18	Res, 1.62K, 1%, 1/8W MF	1075-0070	Dale	MFF 1/8
R19	Res, 3.4K, 1%, 1/8W MF	1075-0020	Dale	MFF 1/8
R20	Res, 3.4K, 1%, 1/8W MF	1075-0020	Dale	MFF 1/8
R21	Res, 1K, 1%, 1/8W MF	1075-0037	Dale	MFF 1/8
R22	Res, 10K, 1%, 1/8W MF	1075-0009	Dale	MFF 1/8
R23	Res, 1K, 1%, 1/8W MF	1075-0037	Dale	MFF 1/8
R24	Res, 3K, 5%, 1/4W Comp	1066-3025	Allen-Bradley	CB3025
R25	Res, 715 Ohm, 1%, 1/8W MF	1075-0085	Dale	MFF 1/8
R26	Res, 10K, 1%, 1/8W MF	1075-0009	Dale	MFF 1/8
R27	Res, 1.62K, 1%, 1/8W MF	1075-0070	Dale	MFF 1/8
R28	Res, 715 Ohm, 1%, 1/8W MF	1075-0085	Dale	MFF 1/8
R29	Res, 10K, 1%, 1/8W MF	1075-0009	Dale	MFF 1/8
R30	Res, 2K, 1%, 1/8W MF	1075-0079	Dale	MFF 1/8

100 Hz VCO and Phase Detector, 2800 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R31	Res, 2.74K, 1%, 1/8W MF	1075-0071	Dale	MFF 1/8
R32	Res, 1K, 1%, 1/8W MF	1075-0037	Dale	MFF 1/8
R33	Res, 4.75K, 1%, 1/8W MF	1075-0038	Dale	MFF 1/8
R34	Res, 2.21K, 1%, 1/8W MF	1075-0010	Dale	MFF 1/8
R35	Res, 1K, 1%, 1/8W MF	1075-0037	Dale	MFF 1/8
R36	Res, 1.5K, 1%, 1/8W MF	1075-0039	Dale	MFF 1/8
R37	Res, 2.21K, 1%, 1/8W MF	1075-0010	Dale	MFF 1/8
R38	Res, 26.1 Ohm, 1%, 1/10W MF	1074-1011	Dale	MFF 1/10
R39	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R40	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R41	Res, 200 Ohm, 5%, 1/4W Comp	1066-2015	Allen-Bradley	CB2015
R42	Res, 430 Ohm, 5%, 1/4W Comp	1066-4315	Allen-Bradley	CB4315
R43	Res, 680 Ohm, 5%, 1/4W Comp	1066-6815	Allen-Bradley	CB6815
R44	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R45	Res, 510 Ohm, 5%, 1/4W Comp	1066-5115	Allen-Bradley	CB5115
	INTEGRATED CIRCUITS			
U1	IC, SN7490N	2025-0002	TI	SN7490N
U2	IC, MC4044P Phase Detector	2025-0066	Motorola	MC4044P
U3	IC, SN7400N, TTL Nand Gates	2025-0003	TI	SN7400N
U4	IC, LM308N, Op Ampl 8 Pin	2025-0070	National	LM308N
U5	IC, SN7400N, TTL Nand Gates	2025-0003	TI	SN7400N
U6	IC, SN7490N	2025-0002	TI	SN7490N





NOTE:
1. RESISTORS – 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS – VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS – VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.
6. ALL DIODES ARE 1N3064 UNLESS OTHERWISE NOTED.

U NO	TYPE	VCC	GND
1,6	7490	5	10
4	LM308		
2	MC4044	16	7
3,5	7400	14	7

Figure 6-10. 100 Hz VCO and Phase Detector, 2800

5601**0065**2

Microwave Casting Assembly, 3000

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3000	Microwave Casting Assembly	7046-0036	Cushman	
	CAPACITORS			
C1	Not Used			
C2	Not Used			
C3	Not Used			
C4-C19	Feedthru, 1000pF, GMV, 500V	1005-0083	Sprague	514C1
C20	Elec, 25μF, +75-10%, 25V	1013-0010	Illinois	25T25
	DIODES			
CR1	Si, 1N3064	1281-0013	Teledyne	1N3064
CR2	Si, 1N3064	1281-0013	Teledyne	1N3064
	CONNECTORS			
J1	Submini Straight	2536-0046	Phelps-Dodge	700006
J2	Submini Straight	2536-0046	Phelps-Dodge	700006
J3	Submini Straight	2536-0046	Phelps-Dodge	700006
J4	PC Board 12 Contact, Double Row	2535-0052	Viking	2VK6D/1-1
J5	Submini Straight	2536-0046	Phelps-Dodge	700006
J6	Submini Straight	2536-0046	Phelps-Dodge	700006
P1	Submini, Right Angle	2536-0044	Phelps-Dodge	700085
P2	Submini, Right Angle	2536-0044	Phelps-Dodge	700085
P3	Submini, Right Angle	2536-0044	Phelps-Dodge	700085
P4	Not Used			
P5	Submini, Right Angle	2536-0044	Phelps-Dodge	700085
P6	Submini, Right Angle	2536-0044	Phelps-Dodge	700085
	INDUCTORS			
L1	RFC, .22μH, ±20%	1585-0039	Delevan	1537-02
L2	RFC, .22μH, ±20%	1585-0039	Delevan	1537-02
L3	RFC, .22μH, ±20%	1585-0039	Delevan	1537-02
L4	Not Used			
L5-7	RFC, Ferrite Bead μ250	1586-0004	Ferroxcube	56-590-65/4B
L8	Not Used			
L9-11	RFC, Ferrite Bead μ250	1586-0004	Ferroxcube	56-590-65/4B
L12	Not Used			
L13	Not Used			
L14-26	RFC, Ferrite Bead μ250	1586-0004	Ferroxcube	56-590-65/4B
	RESISTORS			
R1	Comp, 2.4k, ±5%, 1/4W	1066-2425	Allen-Bradley	CB2425
R2	Comp, 2.7k, ±5%, 1/4W	1066-2725	Allen-Bradley	CB2725
R3	Res, 51 Ohm, 5%, 1/4W CC	1066-5105	Allen-Bradley	CB5105

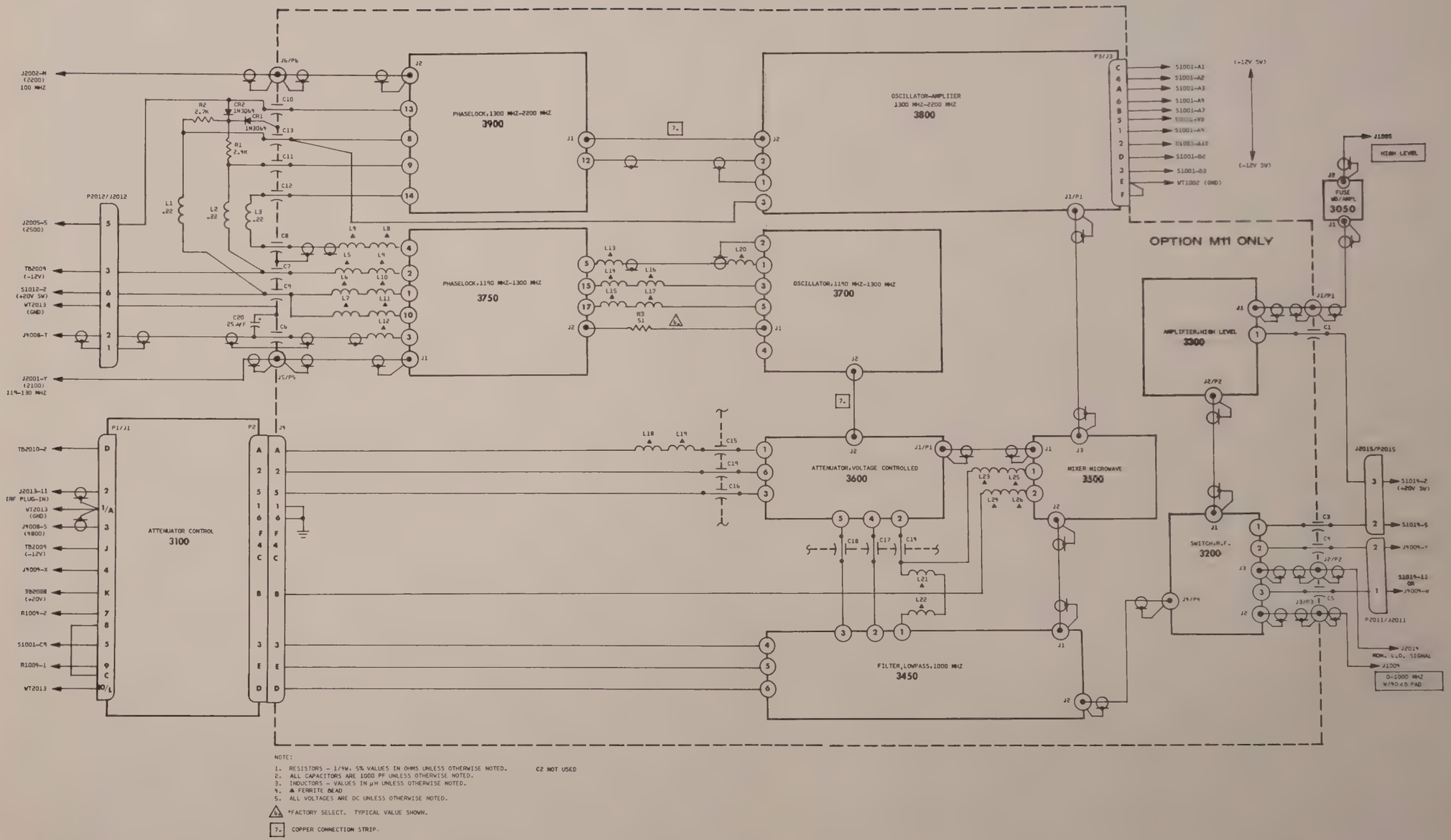


Figure 6-11. Microwave Casting Interconnection Diagram, 3000

Attenuator Control, 3100

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3100	PCB Assy - Attenuator Control	7001-0402	Cushman	
	PC Board	1780-0517	Cushman	
	CAPACITORS			
C1	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C2	Cap, 270PF, 5%, 500V Mica	1002-0031	Elmenco	DM15-F-271J
C3	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C4	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C5	Cap, 10PF, 5%, 500V Mica	1002-0016	Elmenco	DM15-C-100J
C6	Cap, 10μF, 10%, 20V	1011-0007	Kemet	K10C20K
C7	Cap, 10μF, 10%, 20V	1011-0007	Kemet	K10C20K
C8	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C9	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C10	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C11	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C12	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C13	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C14	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C15	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C16	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C17	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C18	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
	DIODES			
CR1	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR2	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR3	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR4	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR5	Diode, 1N3064	1281-0013	Teledyne	1N3064
	INDUCTORS			
L1	Choke, .22μH, 20%	1585-0039	Delevan	1537-02
L2	Choke, .22μH, 20%	1585-0039	Delevan	1537-02
L3	Choke, .22μH, 20%	1585-0039	Delevan	1537-02
L4	Choke, .22μH, 20%	1585-0039	Delevan	1537-02
L5	Choke, .22μH, 20%	1585-0039	Delevan	1537-02
L6	Choke, .22μH, 20%	1585-0039	Delevan	1537-02
	TRANSISTORS			
Q1	Trans, 2N3904	1272-0032	Motorola	2N3904
Q2	Trans, 2N3904	1272-0032	Motorola	2N3904
Q3	Trans, 2N3904	1272-0032	Motorola	2N3904
Q4	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q5	Trans, 2N3906	1272-0037	Motorola	2N3906
Q6	Trans, 2N3904	1272-0032	Motorola	2N3904
Q7	Trans, 2N3904	1272-0032	Motorola	2N3904
Q8	Trans, 2N3565	1272-0017	Fairchild	2N3565
	RESISTORS			
R1	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R2	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R3	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R4	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R5	Res, 22K, 5%, 1/4W Comp	1066-2235	Allen-Bradley	CB2235

Attenuator Control, 3100 (cont)

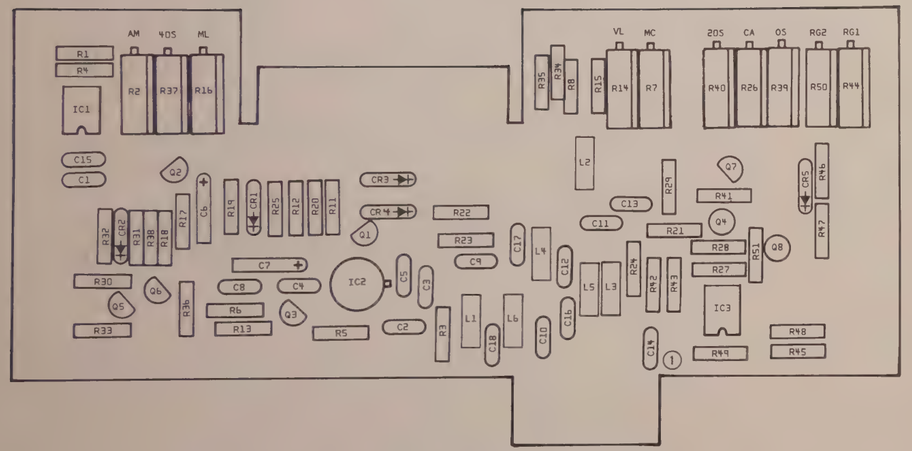
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R6	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R7	Pot, 5K, 10%, 3/4W	1215-0012	Helitrim	89WR
R8	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R9	Not Used			
R10	Not Used			
R11	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R12	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R13	Res, 6.8K, 5%, 1/4W Comp	1066-6825	Allen-Bradley	CB6825
R14	Pot, 20K, 10%, 3/4W	1215-0021	Beckman	89WR
R15	Res, 18K, 5%, 1/4W Comp	1066-1835	Allen-Bradley	CB1835
R16	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R17	Res, 5.6K, 5%, 1/4W Comp	1066-5625	Allen-Bradley	CB5625
R18	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R19	Res, 3.6K, 5%, 1/4W Comp	1066-3625	Allen-Bradley	CB3625
R20	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R21	Res, 51K, 5%, 1/4W Comp	1066-5135	Allen-Bradley	CB5135
R22	Res, 2K, 5%, 1/4W Comp	1066-2025	Allen-Bradley	CB2025
R23	Res, 9.1K, 5%, 1/4W Comp	1066-9125	Allen-Bradley	CB9125
R24	Res, 27K, 5%, 1/4W Comp	1066-2735	Allen-Bradley	CB2735
R25	Res, 3.6K, 5%, 1/4W Comp	1066-3625	Allen-Bradley	CB3625
R26	Pot, 20K, 10%, 3/4W	1215-0021	Beckman	89WR
R27	Res, 20K, 1%, 1/8W MF	1075-0096	Dale	MFF 1/8
R28	Res, 1.05K, 1%, 1/8W MF	1075-0086	Dale	MFF 1/8
R29	Res, 27K, 5%, 1/4W Comp	1066-2735	Allen-Bradley	CB2735
R30	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R31	Res, 4.3K, 5%, 1/4W Comp	1066-4325	Allen-Bradley	CB4325
R32	Res, 68 Ohm, 5%, 1/4W Comp	1066-6805	Allen-Bradley	CB6805
R33	Res, 4.3K, 5%, 1/4W Comp	1066-4325	Allen-Bradley	CB4325
R34	Res, 1.8K, 5%, 1/4W Comp	1066-1825	Allen-Bradley	CB1825
R35	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R36	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R37	Pot, 20K, 10%, 3/4W	1215-0021	Beckman	89WR
R38	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R39	Pot, 20K, 10%, 3/4W	1215-0021	Beckman	89WR
R40	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R41	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R42	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R43	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R44	Pot, 20K, 10%, 3/4W	1215-0021	Beckman	89WR
R45	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R46	Thrmis - 1K	1253-0002	Veco	31E2
R47	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R48	Res, 220 Ohm, 5%, 1/4W Comp	1066-2215	Allen-Bradley	CB2215
R49	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R50	Pot, 5K, 10%, 3/4W	1215-0012	Helitrim	89WR
R51	Res, 4.3K, 5%, 1/4W Comp	1066-4325	Allen-Bradley	CB4325
R52	Res, 43K, 5%, 1/4W Carbon Comp	1066-4335	Allen-Bradley	CB4335
	INTEGRATED CIRCUITS			
U1	IC, SN72741P	2025-0067	Signetics	UA741CV
U2	IC, LM301A Op Amp	2025-0032	National	LM301A
U3	IC, SN72741P	2025-0067	Signetics	UA741CV

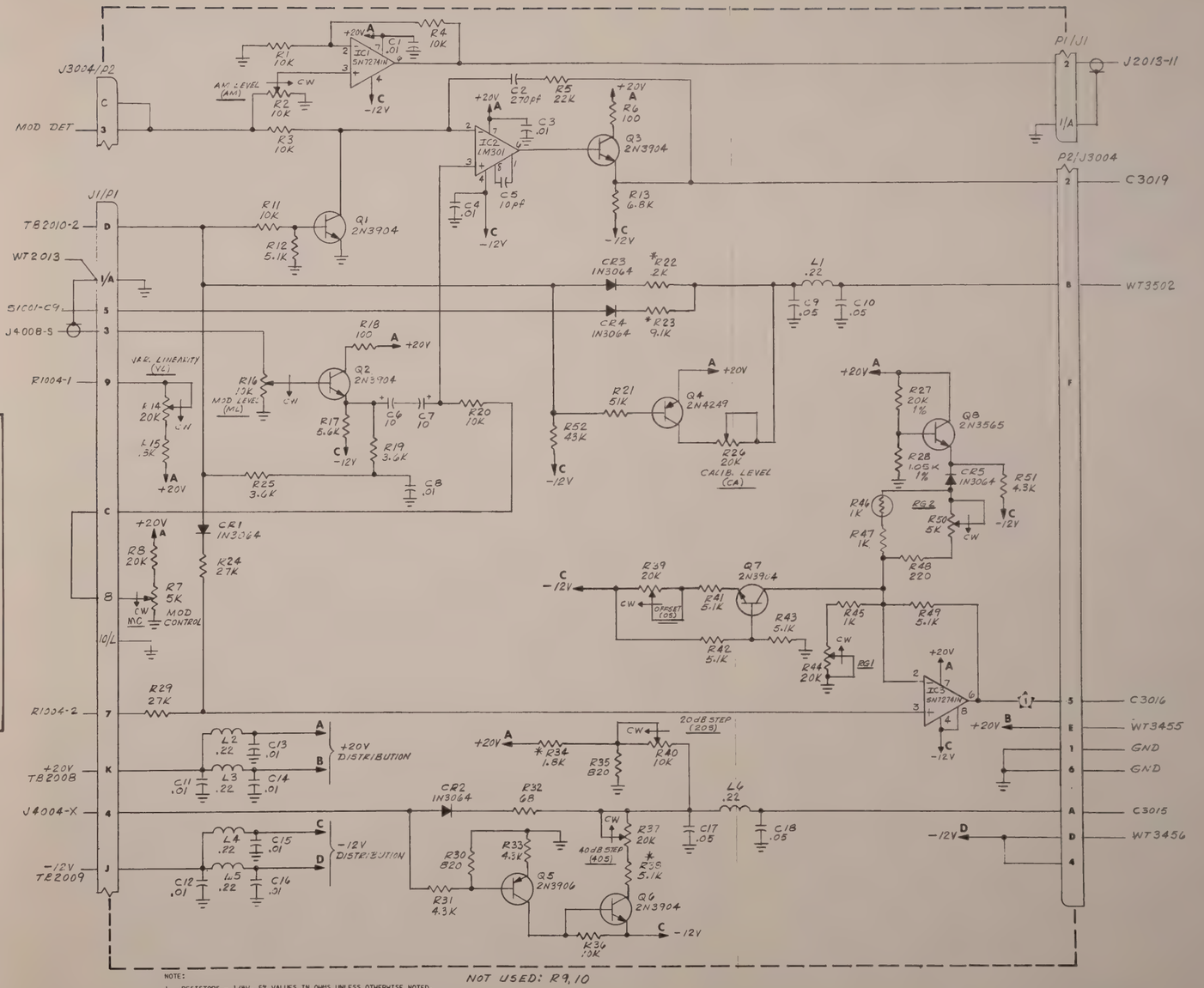
Attenuator Control, 3100

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3100	PCB Assy - Attenuator Control	7001-0402	Cushman	
	PC Board	1780-0517	Cushman	
	CAPACITORS			
C1	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C2	Cap, 270PF, 5%, 500V Mica	1002-0031	Elmenco	DM15-F-271J
C3	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C4	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C5	Cap, 10PF, 5%, 500V Mica	1002-0016	Elmenco	DM15-C-100J
C6	Cap, 10μF, 10%, 20V	1011-0007	Kemet	K10C20K
C7	Cap, 10μF, 10%, 20V	1011-0007	Kemet	K10C20K
C8	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C9	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C10	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C11	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C12	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C13	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C14	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C15	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C16	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C17	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C18	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
	DIODES			
CR1	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR2	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR3	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR4	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR5	Diode, 1N3064	1281-0013	Teledyne	1N3064
	INDUCTORS			
L1	Choke, .22μH, 20%	1585-0039	Delevan	1537-02
L2	Choke, .22μH, 20%	1585-0039	Delevan	1537-02
L3	Choke, .22μH, 20%	1585-0039	Delevan	1537-02
L4	Choke, .22μH, 20%	1585-0039	Delevan	1537-02
L5	Choke, .22μH, 20%	1585-0039	Delevan	1537-02
L6	Choke, .22μH, 20%	1585-0039	Delevan	1537-02
	TRANSISTORS			
Q1	Trans, 2N3904	1272-0032	Motorola	2N3904
Q2	Trans, 2N3904	1272-0032	Motorola	2N3904
Q3	Trans, 2N3904	1272-0032	Motorola	2N3904
Q4	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q5	Trans, 2N3906	1272-0037	Motorola	2N3906
Q6	Trans, 2N3904	1272-0032	Motorola	2N3904
Q7	Trans, 2N3904	1272-0032	Motorola	2N3904
Q8	Trans, 2N3565	1272-0017	Fairchild	2N3565
	RESISTORS			
R1	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R2	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R3	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R4	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R5	Res, 22K, 5%, 1/4W Comp	1066-2235	Allen-Bradley	CB2235

Attenuator Control, 3100 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R6	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R7	Pot, 5K, 10%, 3/4W	1215-0012	Helitrim	89WR
R8	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R9	Not Used			
R10	Not Used			
R11	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R12	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R13	Res, 6.8K, 5%, 1/4W Comp	1066-6825	Allen-Bradley	CB6825
R14	Pot, 20K, 10%, 3/4W	1215-0021	Beckman	89WR
R15	Res, 18K, 5%, 1/4W Comp	1066-1835	Allen-Bradley	CB1835
R16	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R17	Res, 5.6K, 5%, 1/4W Comp	1066-5625	Allen-Bradley	CB5625
R18	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R19	Res, 3.6K, 5%, 1/4W Comp	1066-3625	Allen-Bradley	CB3625
R20	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R21	Res, 51K, 5%, 1/4W Comp	1066-5135	Allen-Bradley	CB5135
R22	Res, 2K, 5%, 1/4W Comp	1066-2025	Allen-Bradley	CB2025
R23	Res, 9.1K, 5%, 1/4W Comp	1066-9125	Allen-Bradley	CB9125
R24	Res, 27K, 5%, 1/4W Comp	1066-2735	Allen-Bradley	CB2735
R25	Res, 3.6K, 5%, 1/4W Comp	1066-3625	Allen-Bradley	CB3625
R26	Pot, 20K, 10%, 3/4W	1215-0021	Beckman	89WR
R27	Res, 20K, 1%, 1/8W MF	1075-0096	Dale	MFF 1/8
R28	Res, 1.05K, 1%, 1/8W MF	1075-0086	Dale	MFF 1/8
R29	Res, 27K, 5%, 1/4W Comp	1066-2735	Allen-Bradley	CB2735
R30	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R31	Res, 4.3K, 5%, 1/4W Comp	1066-4325	Allen-Bradley	CB4325
R32	Res, 68 Ohm, 5%, 1/4W Comp	1066-6805	Allen-Bradley	CB6805
R33	Res, 4.3K, 5%, 1/4W Comp	1066-4325	Allen-Bradley	CB4325
R34	Res, 1.8K, 5%, 1/4W Comp	1066-1825	Allen-Bradley	CB1825
R35	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R36	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R37	Pot, 20K, 10%, 3/4W	1215-0021	Beckman	89WR
R38	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R39	Pot, 20K, 10%, 3/4W	1215-0021	Beckman	89WR
R40	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R41	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R42	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R43	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R44	Pot, 20K, 10%, 3/4W	1215-0021	Beckman	89WR
R45	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R46	Thrmis - 1K	1253-0002	Veco	31E2
R47	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R48	Res, 220 Ohm, 5%, 1/4W Comp	1066-2215	Allen-Bradley	CB2215
R49	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R50	Pot, 5K, 10%, 3/4W	1215-0012	Helitrim	89WR
R51	Res, 4.3K, 5%, 1/4W Comp	1066-4325	Allen-Bradley	CB4325
R52	Res, 43K, 5%, 1/4W Carbon Comp	1066-4335	Allen-Bradley	CB4335
	INTEGRATED CIRCUITS			
U1	IC, SN72741P	2025-0067	Signetics	UA741CV
U2	IC, LM301A Op Amp	2025-0032	National	LM301A
U3	IC, SN72741P	2025-0067	Signetics	UA741CV



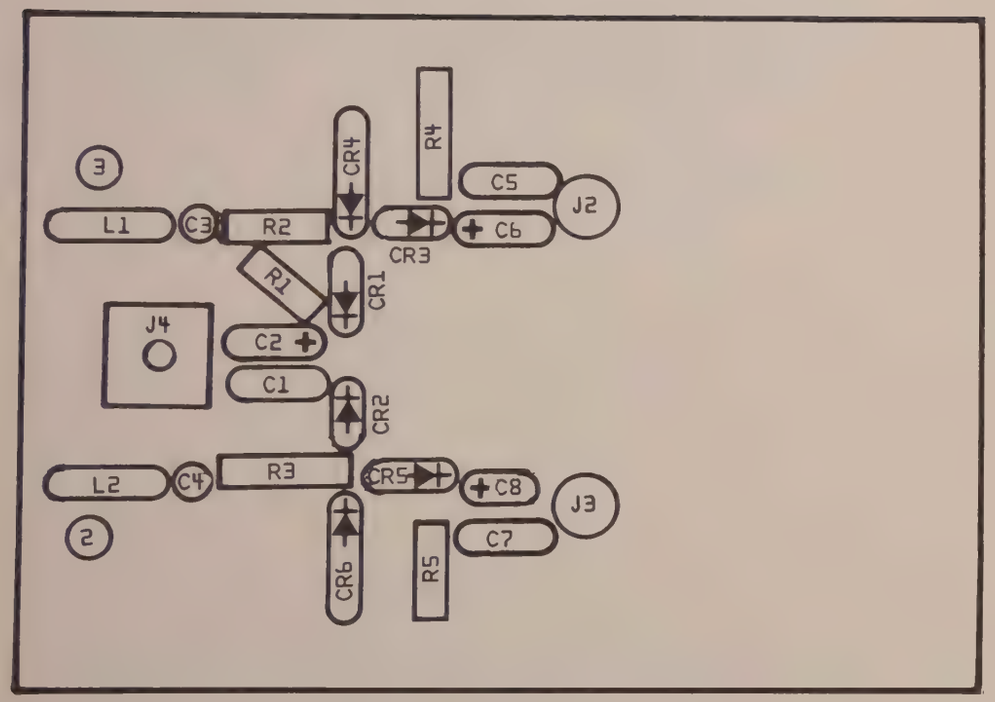


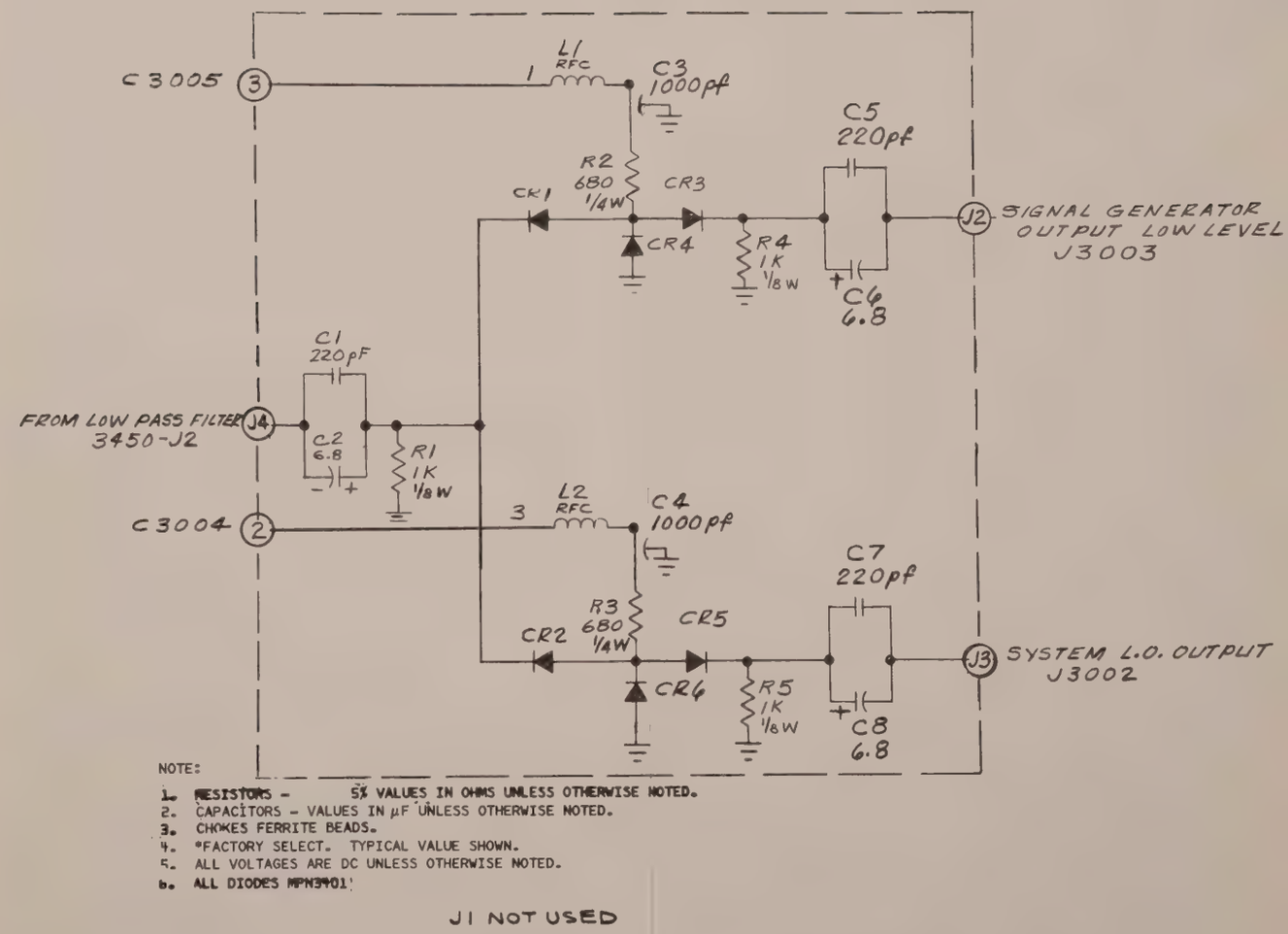
NOTE:
1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

Figure 6-12. Attenuator Control, 3100

R. F. Switch, 3200

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3200	PCB Assy - Switch RF	7001-0401	Cushman	
	PC Board	1780-0281	Cushman	
	CAPACITORS			
C1	Cap, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C2	Cap, 6.8μF, 20%, 20V	1012-0001	Kemet	T411D685M020AU
C3	Cap, 1000PF, +100-0%, Feedthru	1005-0077	Allen-Bradley	FW5N
C4	Cap, 1000PF, +100-0%, Feedthru	1005-0077	Allen-Bradley	FW5N
C5	Cap, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C6	Cap, 6.8μF, 20%, 20V	1012-0001	Kemet	T411D685M020AU
C7	Cap, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C8	Cap, 6.8μF, 20%, 20V	1012-0001	Kemet	T411D685M020AU
	DIODES			
CR1	Diode, MPN3401	1281-0050	Motorola	MPN-3401
CR2	Diode, MPN3401	1281-0050	Motorola	MPN-3401
CR3	Diode, MPN3401	1281-0050	Motorola	MPN-3401
CR4	Diode, MPN3401	1281-0050	Motorola	MPN-3401
CR5	Diode, MPN3401	1281-0050	Motorola	MPN-3401
CR6	Diode, MPN3401	1281-0050	Motorola	MPN-3401
	INDUCTORS			
L1	Choke, U-250 Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L2	Choke, U-250 Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
	RESISTORS			
R1	Res, 1K, 5%, 1/8W Comp	1065-1025	Allen-Bradley	BB1025
R2	Res, 680 Ohm, 5%, 1/4W Comp	1066-6815	Allen-Bradley	CB6815
R3	Res, 680 Ohm, 5%, 1/4W Comp	1066-6815	Allen-Bradley	CB6815
R4	Res, 1K, 5%, 1/8W Comp	1065-1025	Allen-Bradley	BB1025
R5	Res, 1K, 5%, 1/8W Comp	1065-1025	Allen-Bradley	BB1025





NOTE:

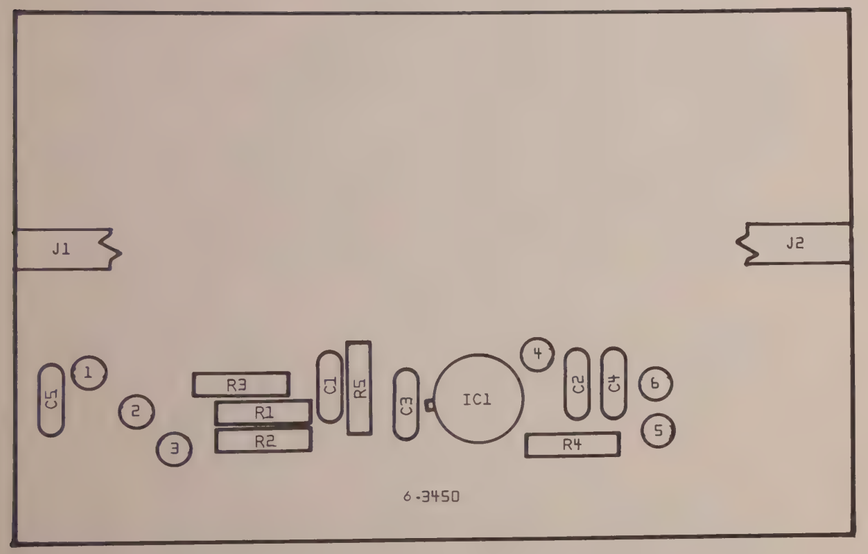
1. RESISTORS - 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. CHOKES FERRITE BEADS.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.
6. ALL DIODES MPN3401

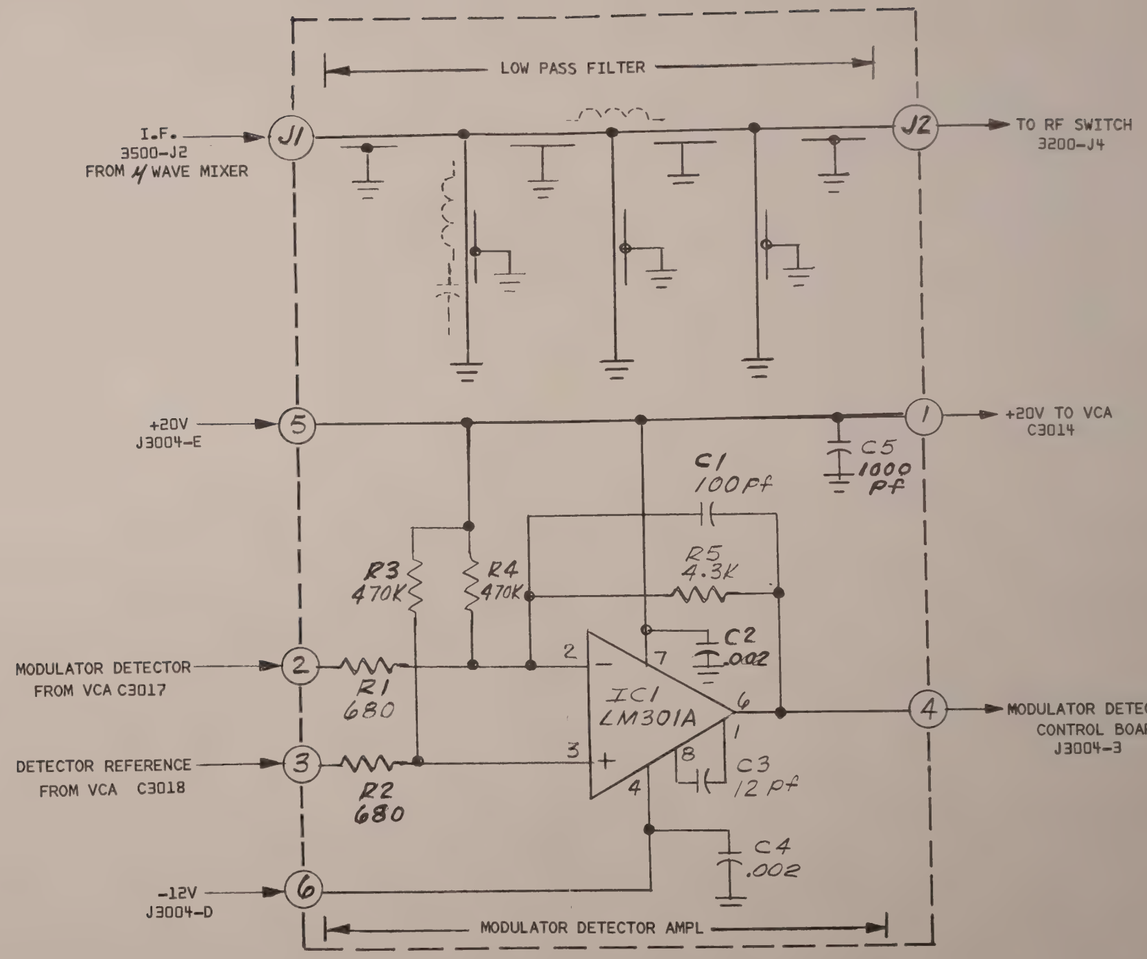
J1 NOT USED

Figure 6-13. R. F. Switch, 3200

1000 MHz Low Pass Filter, 3450

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3450	Assy, PCB Filter Low Pass 1000 MHz	7001-0154	Cushman	
	PC Board	1780-0312		
	CAPACITORS			
C1	Cap, 100PF, 5%, 500V Mica	1002-0011	Elmenco	DM15-F-101J
C2	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C3	Cap, 12PF, 5%, 500V Mica	1002-0017	Elmenco	DM15-C-120J
C4	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C5	Cap, 1000PF, 10%, 100V Min Cer	1005-0081	Erie	8121-100-W5R-102K
	RESISTORS			
R1	Res, 680 Ohm, 5%, 1/4W Comp	1066-6815	Allen-Bradley	CB6815
R2	Res, 680 Ohm, 5%, 1/4W Comp	1066-6815	Allen-Bradley	CB6815
R3	Res, 470K, 5%, 1/4W Comp	1066-4745	Allen-Bradley	CB4745
R4	Res, 470K, 5%, 1/4W Comp	1066-4745	Allen-Bradley	CB4745
R5	Res, 4.3K, 5%, 1/4W Comp	1066-4325	Allen-Bradley	CB4325
	INTEGRATED CIRCUIT			
U1	IC, LM301A Op Amp	2025-0032	National	LM301A





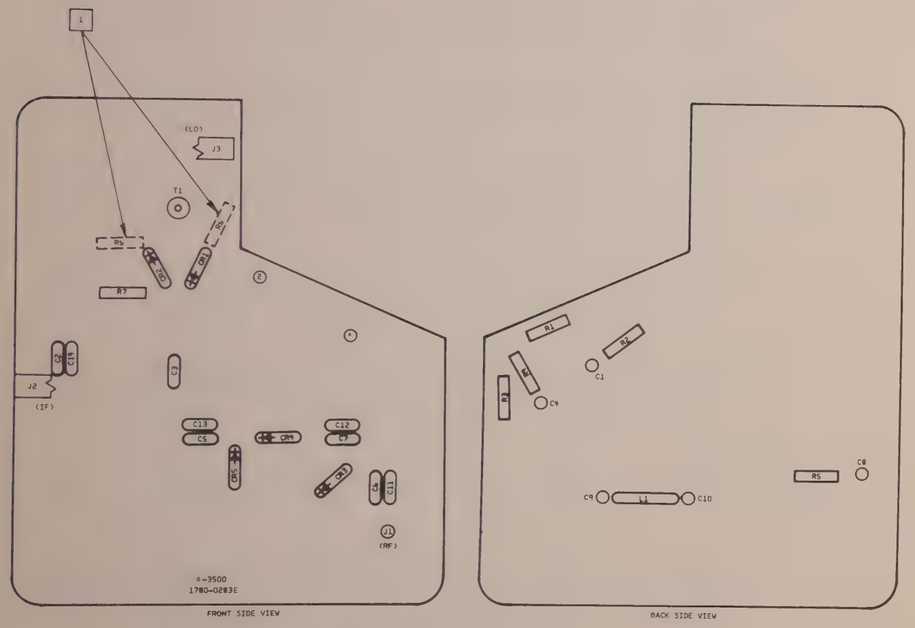
NOTE:

1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

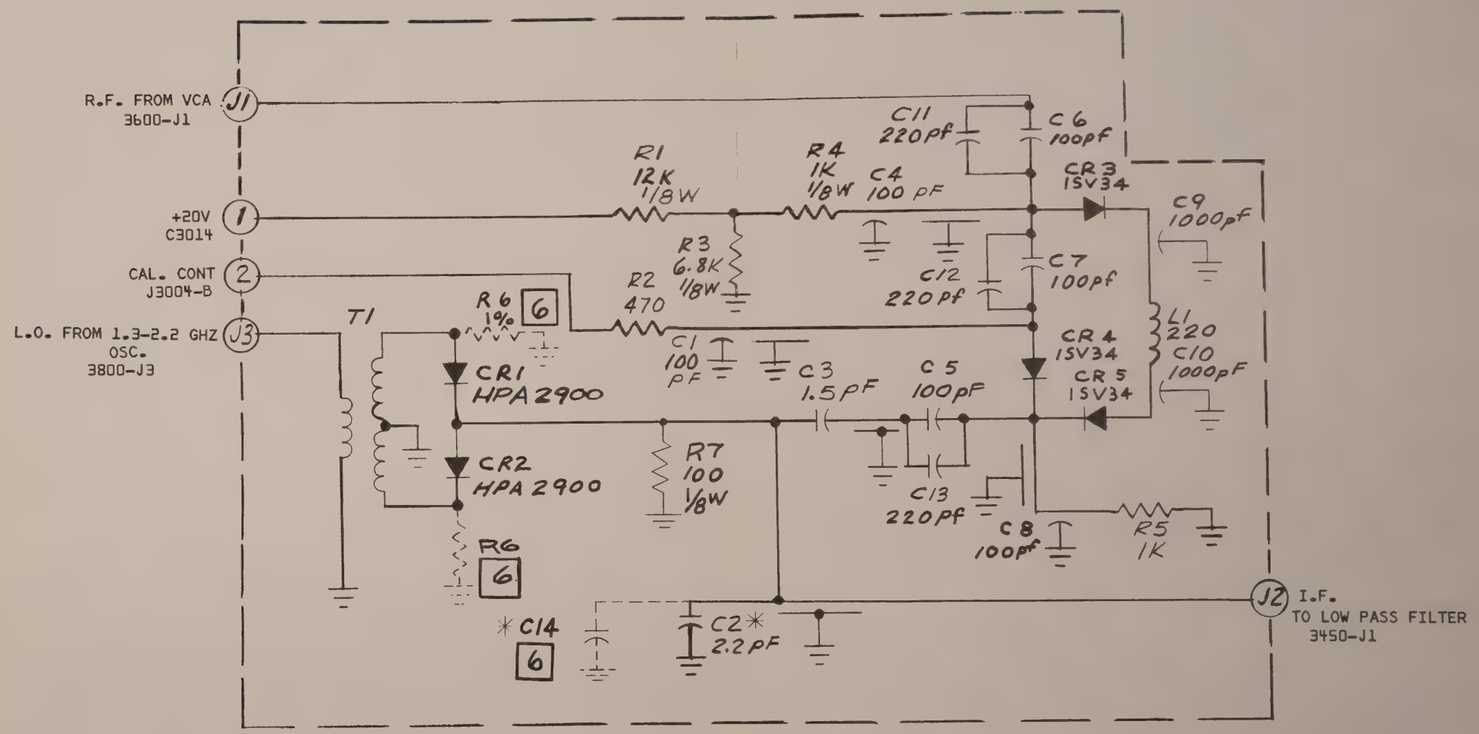
Figure 6-14. 1000 MHz Low Pass Filter, 3450

Microwave Mixer, 3500

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3500	Assy, PC Bd. Mixer Microwave	7001-0155	Cushman	
	PC Board	1780-0283	Cushman	
	CAPACITORS			
C1	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C2	Cap, 2.2PF, .25PF%, 50V	1012-0003	Varadyne	3BN050S2R2C(S)
C3	Cap, 1.5PF, .25PF%, 50V	1005-0121	ACI	FD35NPO1H1R5C
C4	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C5	Cap, 100PF, 10%, 50V	1012-0004	Varadyne	3BX050S101K(S)
C6	Cap, 100PF, 10%, 50V	1012-0004	Varadyne	3BX050S101K(S)
C7	Cap, 100PF, 10%, 50V	1012-0004	Varadyne	3BX050S101K(S)
C8	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C9	Cap, 1000PF, +100-0%, Feed Thru	1005-0077	Allen-Bradley	FW5N
C10	Cap, 1000PF, +100-0%, Feed Thru	1005-0077	Allen-Bradley	FW5N
C11	Cap, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C12	Cap, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C13	Cap, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C14	Cap, FSV Chip			
	DIODES			
CR1	Diode, HPA2900	1283-0003	HPA	5082-2900
CR2	Diode, HPA2900	1283-0003	HPA	5082-2900
CR3	Diode, Microwave Pin, 1SV34	1281-0075	Nippon Elec	1SV34
CR4	Diode, Microwave Pin, 1SV34	1281-0075	Nippon Elec	1SV34
CR5	Diode, Microwave Pin, 1SV34	1281-0075	Nippon Elec	1SV34
	INDUCTOR			
L1	Choke, 220μH, 5%	1585-0018	Delevan	1537-92
	RESISTORS			
R1	Res, 12K, 5%, 1/8W Comp	1065-1235	Allen-Bradley	BB1235
R2	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R3	Res, 6.8K, 5%, 1/8W Comp	1065-6825	Allen-Bradley	BB6825
R4	Res, 1K, 5%, 1/8W Comp	1065-1025	Allen-Bradley	BB1025
R5	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	BB1025
R6	Res, FSV 1%, 1/8W MF	1075-xxxx	Dale	MF 1/8
R7	Res, 100 Ohm, 5%, 1/8W Comp	1065-1015	Allen-Bradley	BB1015
R8	Res, 49.9 Ohm, 1%, 100 PPM, 1/20W	1075-0141	Dale	MFF 1/20
	TRANSFORMER			
T1	Transformer, Toroidal Bifilar	1579-0026	Cushman	



1. FACTORY SELECT, MAY BE ADDED IN EITHER LOCATION SHOWN, IF REQUIRED.



NOTE:

1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.
6. FACTORY SELECT. MAY BE ADDED TO SOME UNITS IN EITHER LOCATION SHOWN.

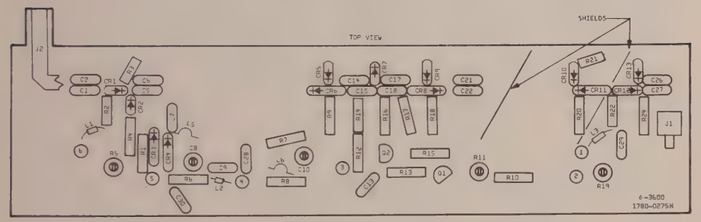
Figure 6-15. Microwave Mixer, 3500

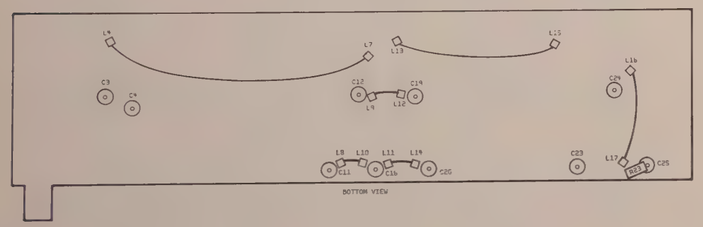
Voltage Controlled Attenuator, 3600

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3600	Assy, PCB Atten Voltage Control	7001-0156	Cushman	
	PC Board	1780-0275	Cushman	
	CAPACITORS			
C1	Cap, 100PF, 10%, 50V	1012-0004	Varadyne	3BX050S101K(S)
C2	Cap, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C3	Cap, 1000PF, +100-0%, Feed Thru	1005-0077	Allen-Bradley	FW5N
C4	Cap, 1000PF, +100-0%, Feed Thru	1005-0077	Allen-Bradley	FW5N
C5	Cap, 100PF, 10%, 50V	1012-0004	Varadyne	3BX050S101K(S)
C6	Cap, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C7	Cap, 4.7PF, .25PF%, 50V	1012-0009	Varadyne	3BN050S4R7C(S)
C8	Cap, 1.3-5.4PF, Air Var.	1000-0012	EF Johnson	187-0103-005
C9	Cap, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C10	Cap, 1.3-5.4PF, Air Var.	1000-0012	EF Johnson	187-0103-005
C11	Cap, 1000PF, +100-0%, Feed Thru	1005-0077	Allen-Bradley	FW5N
C12	Cap, 1000PF, +100-0%, Feed Thru	1005-0077	Allen-Bradley	FW5N
C13	Cap, 1000PF, 10%, 100V Min Cer	1005-0081	Erie	8121-100-W5R-102K
C14	Cap, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C15	Cap, 100PF, 10%, 50V	1012-0004	Varadyne	3BX050S101K(S)
C16	Cap, 1000PF, +100-0%, Feed Thru	1005-0077	Allen-Bradley	FW5N
C17	Cap, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C18	Cap, 100PF, 10%, 50V	1012-0004	Varadyne	3BX050S101K(S)
C19	Cap, 1000PF, +100-0%, Feed Thru	1005-0077	Allen-Bradley	FW5N
C20	Cap, 1000PF, +100-0%, Feed Thru	1005-0077	Allen-Bradley	FW5N
C21	Cap, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C22	Cap, 100PF, 10%, 50V	1012-0004	Varadyne	3BX050S101K(S)
C23	Cap, 1000PF, +100-0%, Feed Thru	1005-0077	Allen-Bradley	FW5N
C24	Cap, 1000PF, +100-0%, Feed Thru	1005-0077	Allen-Bradley	FW5N
C25	Cap, 1000PF, +100-0%, Feed Thru	1005-0077	Allen-Bradley	FW5N
C26	Cap, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C27	Cap, 100PF, 10%, 50V	1012-0004	Varadyne	3BX050S101K(S)
C28	Cap, 1000PF, 10%, 100V Min Cer	1005-0081	Erie	8121-100-W5R-102K
C29	Cap, 1000PF, 10%, 100V Min Cer	1005-0081	Erie	8121-100-W5R-102K
C30	Cap, 10PF, 10%, 100V Mini	1005-0074	Erie	8101-100-C0G-100K
	DIODES			
CR1	Diode, Microwave Pin, 1N5767	1281-0140	HP	1N5767
CR2	Diode, Microwave Pin, 1N5767	1281-0140	HP	1N5767
CR3	Diode, HPA2811	1283-0004	HP	5082-2811
CR4	Diode, HPA2811	1283-0004	HP	5082-2811
CR5	Diode, Microwave Pin, 1N5767	1281-0140	HP	1N5767
CR6	Diode, Microwave Pin, 1N5767	1281-0140	HP	1N5767
CR7	Diode, Microwave Pin, 1N5767	1281-0140	HP	1N5767
CR8	Diode, Microwave Pin, 1N5767	1281-0140	HP	1N5767
CR9	Diode, Microwave Pin, 1N5767	1281-0140	HP	1N5767
CR10	Diode, Microwave Pin, 1N5767	1281-0140	HP	1N5767
CR11	Diode, Microwave Pin, 1N5767	1281-0140	HP	1N5767
CR12	Diode, Microwave Pin, 1N5767	1281-0140	HP	1N5767
CR13	Diode, Microwave Pin, 1N5767	1281-0140	HP	1N5767

Voltage Controlled Attenuator, 3600 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	INDUCTORS			
L1	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L2	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L3	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L4	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L5	Assy, Coil, .004μH, Half Turn	1596-6301	Cushman	
L6	Assy, Coil, .004μH, Half Turn	1596-6302	Cushman	
L7	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L8	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L9	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L10	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L11	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L12	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L13	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L14	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L15	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L16	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
L17	Choke, U-250, Ferrite Bead	1586-0004	Ferroxcube	56-590-65/4B
	TRANSISTORS			
Q1	Trans, 2N3906	1272-0037	Motorola	2N3906
Q2	Trans, 2N3904	1272-0032	Motorola	2N3904
	RESISTORS			
R1	Res, 47 Ohm, 5%, 1/4W Comp	1066-4705	Allen-Bradley	CB4705
R2	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R3	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R4	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R5	Pot, 20K, 20%, 1/2W	1203-0055	Bourns	3339H-1-203
R6	Res, 47 Ohm, 5%, 1/4W Comp	1066-4705	Allen-Bradley	CB4705
R7	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R8	Res, 51 Ohm, 5%, 1/4W Comp	1066-5105	Allen-Bradley	CB5105
R9	Res, 560 Ohm, 5%, 1/4W Comp	1066-5615	Allen-Bradley	CB5615
R10	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R11	Pot, 5K, 20%, 1/2W	1203-0054	Bourns	3339H-1-502
R12	Res, 750 Ohm, 5%, 1/4W Comp	1066-7515	Allen-Bradley	CB7515
R13	Res, 6.8K, 5%, 1/4W Comp	1066-6825	Allen-Bradley	CB6825
R14	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R15	Res, 6.8K, 5%, 1/4W Comp	1066-6825	Allen-Bradley	CB6825
R16	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R17	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R18	Res, 560 Ohm, 5%, 1/4W Comp	1066-5615	Allen-Bradley	CB5615
R19	Pot, 20K, 20%, 1/2W	1203-0055	Bourns	3339H-1-203
R20	Res, 1.2K, 5%, 1/4W Comp	1066-1225	Allen-Bradley	CB1225
R21	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R22	Res, 390 Ohm, 5%, 1/4W Comp	1066-3915	Allen-Bradley	CB3915
R23	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R24	Res, 1.2K, 5%, 1/4W Comp	1066-1225	Allen-Bradley	CB1225





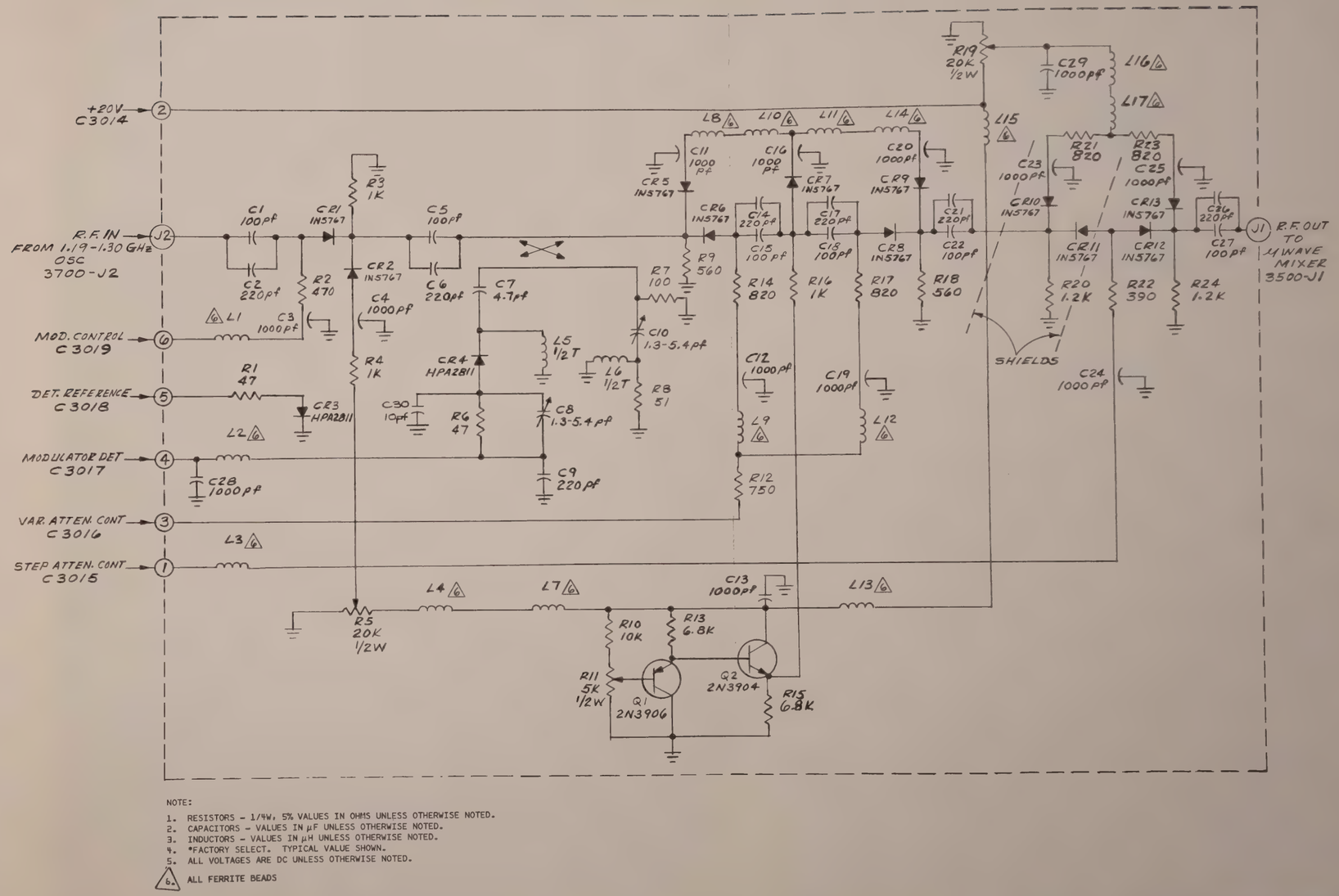
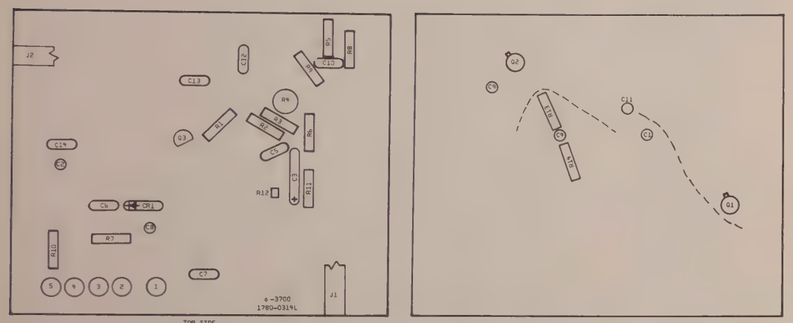
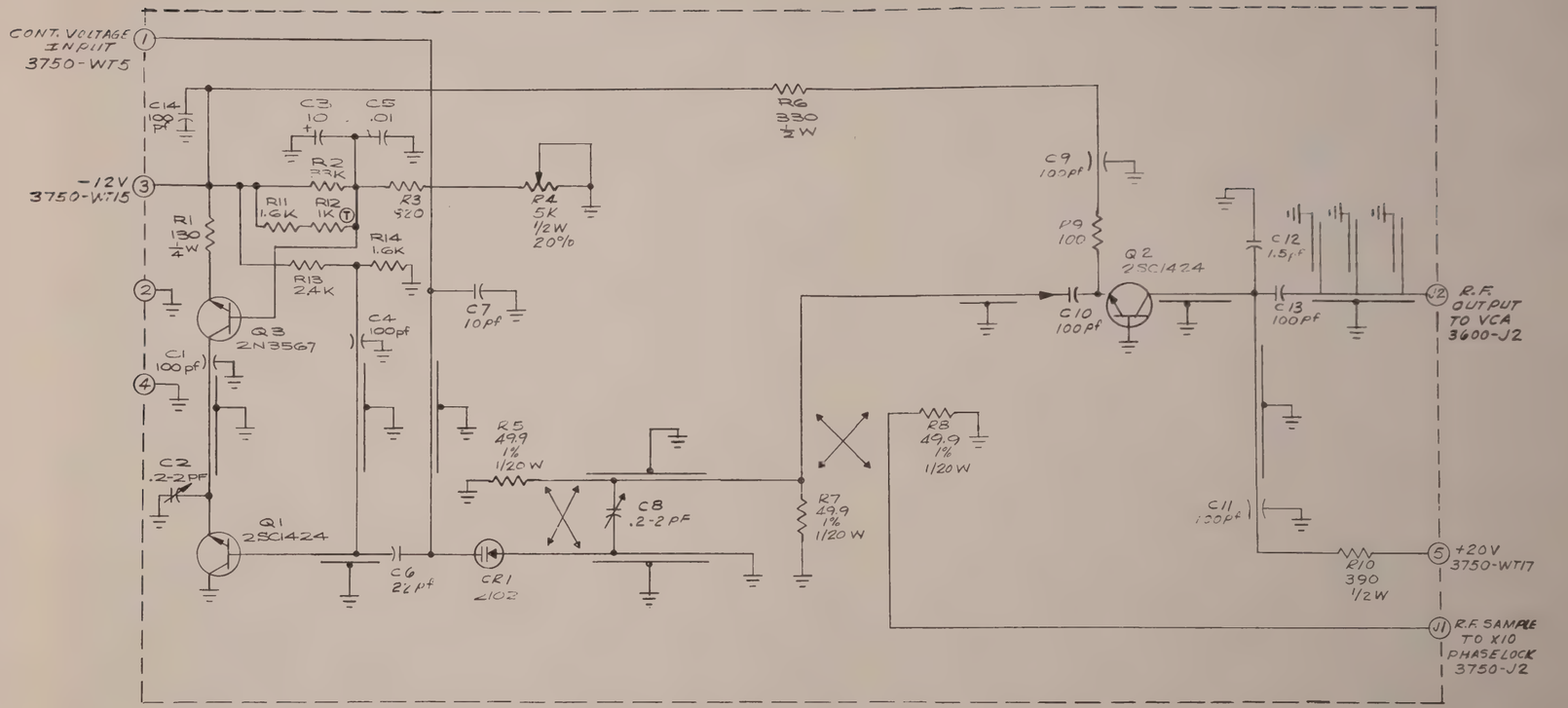

+20V C3014
R.F. IN FROM 1.19-1.30 GHz OSC 3700-J2
MOD. CONTROL C3019
DET. REFERENCE C3018
MODULATOR DET C3017
VAR. ATTEN. CONT C3016
STEP ATTEN. CONT C3015
R.F. OUT TO 1/4 WAVE MIXER 3500-J1
SHIELDS
NOTE:
1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN µF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN µH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.
6. ALL FERRITE BEADS

Figure 6-16. Voltage Controlled Attenuator, 3600

1190 MHz-1300 MHz Oscillator, 3700

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3700	Assy, PC Bd. Osc 1190-1300 MHz	7001-0157	Cushman	
	PC Board	1780-0314	Cushman	
	CAPACITORS			
C1	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C2	Plate, Double Sided Cap	2245-0044	Cushman	
C3	Cap, 10μF, 10%, 20V	1011-0007	Kemet	K10C20K
C4	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C5	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C6	Cap, 22PF, 5%, 50V	1012-0007	Varadyne	3BN050S220J(S)
C7	Cap, 10PF, 10%, 100V Mini	1005-0074	Erie	8101-100-C0G-100K
C8	Plate, Double Sided Cap	2245-0044	Cushman	
C9	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C10	Cap, 100PF, 10%, 50V	1012-0004	Varadyne	3BX050S101K(S)
C11	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C12	Cap, 1.5PF, .25PF%, 50V	1005-0121	ACI	FD35NPO1H1R5C
C13	Cap, 100PF, 10%, 50V	1012-0004	Varadyne	3BX050S101K(S)
C14	Cap, 100PF, 5%, 100V Min Cer	1005-0082	Erie	8121-100-C0G-101K
	DIODE			
CR1	Dio, Varactor SI, 11.5PF, at 3V	1281-0078	Alpha Ind	DKV6533B
	TRANSISTORS			
Q1	Trans, 2SC1424	1272-0071	Nippon Elec	2SC1424
Q2	Trans, 2SC1424	1272-0071	Nippon Elec	2SC1424
Q3	Trans, 2N3567	1272-0014	Fairchild	2N3567
	RESISTORS			
R1	Res, 130 Ohm, 5%, 1/4W Comp	1066-1315	Allen-Bradley	CB1315
R2	Res, 33K, 5%, 1/4W Comp	1066-3335	Allen-Bradley	CB3335
R3	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R4	Pot, 5K, 20%, 1/2W	1203-0054	Bourns	3339H-1-502
R5	Res, 49.9 Ohm, 1%, 100 PPM, 1/20W	1075-0141	Dale	MFF 1/20
R6	Res, 330 Ohm, 5%, 1/2W Comp	1067-3315	Allen-Bradley	EB3315
R7	Res, 49.9 Ohm, 1%, 100 PPM, 1/20W	1075-0141	Dale	MFF 1/20
R8	Res, 49.9 Ohm, 1%, 100 PPM, 1/20W	1075-0141	Dale	MFF 1/20
R9	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R10	Res, 390 Ohm, 5%, 1/2W Comp	1067-3915	Allen-Bradley	EB3915
R11	Res, 1.6K, 5%, 1/4W Comp	1066-1625	Allen-Bradley	CB1625
R12	THRMIS, 1K	1253-0002	Veco	31E2
R13	Res, 2.4K, 5%, 1/4W Comp	1066-2425	Allen-Bradley	CB2425
R14	Res, 1.6K, 5%, 1/4W Comp	1066-1625	Allen-Bradley	CB1625





NOTE:

1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

Figure 6-17. 1190 MHz-1300 MHz Oscillator, 3700

1190 MHz-1300 MHz Phase Lock, 3750

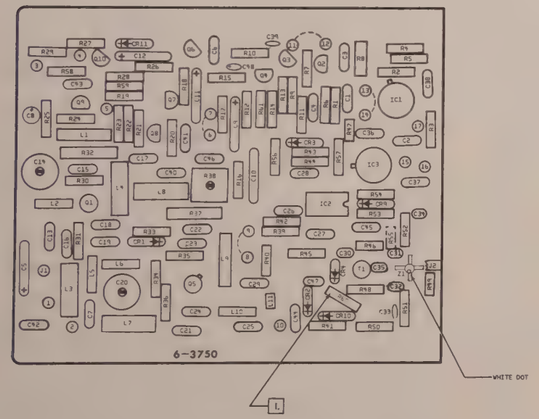
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3750	Assy, PCB Phaselock 1190-1300 MHz	7001-0158	Cushman	
	PC Board	1780-0271	Cushman	
	CAPACITORS			
C1	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C2	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C3	Cap, 5PF, .5PF%, 500V Mica	1002-0028	Elmenco	DM15-C-050D
C4	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C5	Cap, 1.5μF, 10%, 35V	1013-0001	Sprague	150D155X9035B2
C6	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C7	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C8	Cap, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C9	Cap, 3.3μF, 10%, 15V	1011-0008	Kemet	K3R3C15K
C10	Cap, .027μF, 1%, 50V	1008-0064	TRW	863UW
C11	Cap, 3.3μF, 10%, 15V	1011-0008	Kemet	K3R3C15K
C12	Cap, 3.3μF, 10%, 15V	1011-0008	Kemet	K3R3C15K
C13	Cap, 56PF, 5%, 500V Mica	1002-0019	Elmenco	DM15-E-560J
C14	Cap, 5.5-18PF, 350V, Vert Trim	1001-0008	Erie	538-002A-5.5-18
C15	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C16	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C17	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C18	Cap, 180PF, 5%, 500V Mica	1002-0005	Elmenco	DM15-F-181J
C19	Cap, 180PF, 5%, 500V Mica	1002-0005	Elmenco	DM15-F-181J
C20	Cap, 9-35PF, 200V, Vert Trim	1001-0006	Erie	538-002-94D
C21	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C22	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C23	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C24	Cap, 180PF, 5%, 500V Mica	1002-0005	Elmenco	DM15-F-181J
C25	Cap, 30PF, 5%, 500V Mica	1002-0043	Elmenco	DM15-E-300J
C26	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C27	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C28	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C29	Cap, 100PF, 5%, 100V Min Cer	1005-0082	Erie	8121-100-C0G-101K
C30	Cap, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C31	Cap, 100PF, 5%, 100V Min Cer	1005-0082	Erie	8121-100-C0G-101K
C32	Cap, 100PF, 5%, 100V Min Cer	1005-0082	Erie	8121-100-C0G-101K
C33	Cap, 100PF, 5%, 100V Min Cer	1005-0082	Erie	8121-100-C0G-101K
C34	Cap, 100PF, 5%, 100V Min Cer	1005-0082	Erie	8121-100-C0G-101K
C35	Cap, 4.7PF, .25PF%, 50V	1012-0009	Varadyne	3BN050S4R7C(S)
C36	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C37	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C38	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C39	Cap, 100PF, 5%, 100V Min Cer	1005-0082	Erie	8121-100-C0G-101K
C40	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C41	Cap, 150PF, 5%, 500V Mica	1002-0021	Elmenco	DM15-F-151J
C42	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C43	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C44	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C45	Cap, 12PF, 5%, 500V Mica	1002-0017	Elmenco	DM15-C-120J
C46	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C47	Cap, 1000PF, 10%, 100V Min Cer	1005-0081	Erie	8121-100-W5R-102K
C48	Cap, 47μF, 20%, 20V	1011-0009	Dickson	D47GSC20M

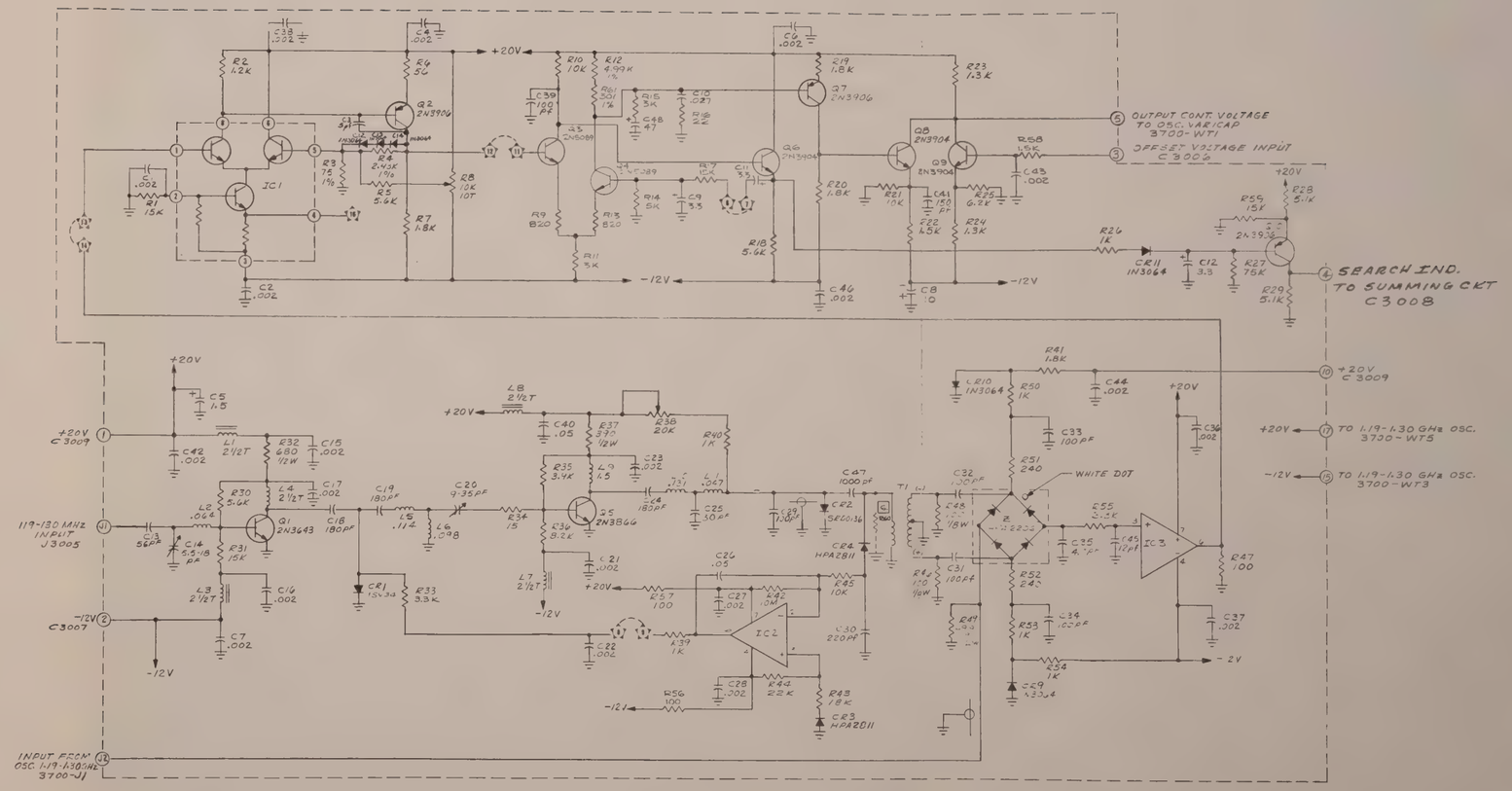
1190 MHz-1300 MHz Phase Lock, 3750 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	DIODES			
CR1	Diode, Microwave Pin, 1SV34	1281-0075	Nippon Elec	1SV34
Z1	Diode, HPA2206 (CR5,6,7,8)	1281-0067	HP	5082-2206
CR2	Diode, HPA0136	1282-0006	HP	5082-0136
CR3	Diode, HPA2811	1283-0004	HP	5082-2811
CR4	Diode, HPA2811	1283-0004	HP	5082-2811
CR9	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR10	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR11	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR12	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR13	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR14	Diode, 1N3064	1281-0013	Teledyne	1N3064
	INDUCTORS			
L1	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L2	Assy, Coil .064μH, RF	1596-5802	Cushman	
L3	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L4	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L5	Assy, Coil, .114μH, RF	1596-5804	Cushman	
L6	Assy, Coil, .098μH, RF	1596-5803	Cushman	
L7	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L8	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L9	Choke, 1.5μH, 10%	1585-0038	Delevan	1537-16
L10	Assy, Coil, .131μH	1596-5805	Cushman	
L11	Assy, Coil, .047μH, RF	1596-5801	Cushman	
	TRANSISTORS			
Q1	Trans, 2N3643	1272-0066	Fairchild	2N3643
Q2	Trans, 2N3906	1272-0037	Motorola	2N3906
Q3	Trans, 2N5089	1272-0031	Motorola	2N5089
Q4	Trans, 2N5089	1272-0031	Motorola	2N5089
Q5	Trans, 2N3866	1271-0005	RCA	2N3866
Q6	Trans, 2N3904	1272-0032	Motorola	2N3904
Q7	Trans, 2N3906	1272-0037	Motorola	2N3906
Q8	Trans, 2N3904	1272-0032	Motorola	2N3904
Q9	Trans, 2N3904	1272-0032	Motorola	2N3904
Q10	Trans, 2N3906	1272-0037	Motorola	2N3906
	RESISTORS			
R1	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R2	Res, 1.2K, 5%, 1/4W Comp	1066-1225	Allen-Bradley	CB1225
R3	Res, 75 Ohm, 1%, 1/8W MF	1075-0035	Dale	MFF 1/8
R4	Res, 2.43K, 1%, 1/8W MF	1075-0019	Dale	MFF 1/8
R5	Res, 5.6K, 5%, 1/4W Comp	1066-5625	Allen-Bradley	CB5625
R6	Res, 56 Ohm, 5%, 1/4W Comp	1066-5605	Allen-Bradley	CB5605
R7	Res, 1.8K, 5%, 1/4W Comp	1066-1825	Allen-Bradley	CB1825
R8	Pot, 10K, 20%, 1/2W	1215-0019	Beckman	66WR10K
R9	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R10	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R11	Res, 3K, 5%, 1/4W Comp	1066-3025	Allen-Bradley	CB3025
R12	Res, 4.99K, 1%, 1/8W MF	1075-0095	Dale	MFF 1/8
R13	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R14	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R15	Res, 3K, 5%, 1/4W Comp	1066-3025	Allen-Bradley	CB3025

1190 MHz-1300 MHz Phase Lock, 3750 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R16	Res, 22 Ohm, 5%, 1/4W Comp	1066-2205	Allen-Bradley	CB2205
R17	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R18	Res, 5.6K, 5%, 1/4W Comp	1066-5625	Allen-Bradley	CB5625
R19	Res, 1.8K, 5%, 1/4W Comp	1066-1825	Allen-Bradley	CB1825
R20	Res, 1.8K, 5%, 1/4W Comp	1066-1825	Allen-Bradley	CB1825
R21	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R22	Res, 1.5K, 5%, 1/4W Comp	1066-1525	Allen-Bradley	CB1525
R23	Res, 1.3K, 5%, 1/4W Comp	1066-1325	Allen-Bradley	CB1325
R24	Res, 1.3K, 5%, 1/4W Comp	1066-1325	Allen-Bradley	CB1325
R25	Res, 6.2K, 5%, 1/4W Comp	1066-6225	Allen-Bradley	CB6225
R26	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R27	Res, 75K, 5%, 1/4W Comp	1066-7535	Allen-Bradley	CB7535
R28	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R29	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R30	Res, 5.6K, 5%, 1/4W Comp	1066-5625	Allen-Bradley	CB5625
R31	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R32	Res, 680 Ohm, 5%, 1/2W Comp	1067-6815	Allen-Bradley	EB6815
R33	Res, 3.3K, 5%, 1/4W Comp	1066-3325	Allen-Bradley	CB3325
R34	Res, 15 Ohm, 5%, 1/4W Comp	1066-1505	Allen-Bradley	CB1505
R35	Res, 3.9K, 5%, 1/4W Comp	1066-3925	Allen-Bradley	CB3925
R36	Res, 8.2K, 5%, 1/4W Comp	1066-8225	Allen-Bradley	CB8225
R37	Res, 390 Ohm, 5%, 1/2W Comp	1067-3915	Allen-Bradley	EB3915
R38	Pot, 20K, 20%, 1W Trim	1200-0028	CTS	360T203B
R39	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R40	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R41	Res, 1.8K, 5%, 1/4W Comp	1066-1825	Allen-Bradley	CB1825
R42	Res, 10 Meg, 5%, 1/4W Comp	1066-1065	Allen-Bradley	CB1065
R43	Res, 18K, 5%, 1/4W Comp	1066-1835	Allen-Bradley	CB1835
R44	Res, 22K, 5%, 1/4W Comp	1066-2235	Allen-Bradley	CB2235
R45	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R46	Res, 100 Ohm, 5%, 1/8W Comp	1065-1015	Allen-Bradley	BB1015
R47	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R48	Res, 100 Ohm, 5%, 1/8W Comp	1065-1015	Allen-Bradley	BB1015
R49	Res, 49.9 Ohm, 1%, 100 PPM 1/20W	1075-0141	Dale	MFF 1/20
R50	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R51	Res, 240 Ohm, 5%, 1/4W Comp	1066-2415	Allen-Bradley	CB2415
R52	Res, 240 Ohm, 5%, 1/4W Comp	1066-2415	Allen-Bradley	CB2415
R53	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R54	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R55	Res, 3.3K, 5%, 1/4W Comp	1066-3325	Allen-Bradley	CB3325
R56	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R57	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R58	Res, 1.5K, 5%, 1/4W Comp	1066-1525	Allen-Bradley	CB1525
R59	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R60	Not Used			
R61	Res, 301 Ohm, 1%, 1/8W MF	1075-0048	Dale	MFF 1/8
	TRANSFORMER			
T1	Assy, Transformer Totoidal Bifilar	1579-0028	Cushman	
	INTEGRATED CIRCUITS			
U1	IC, CA3028B	2025-0061	RCA	CA3028B
U2	IC, SN72741P	2025-0067	TI	SN72741P
U3	IC, LM302 Voltage Follower	2025-0029	National	LM302H





IC NO.	TYPE
1	CA3028B
2	CN7274M
3	LM302H

NOTE:
1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

[4] FACTORY SELECT. REMOVED AFTER TESTING.

Figure 6-18. 1190 MHz-1300 MHz Phase Lock, 3750

1300 MHz-2200 MHz Oscillator, 3800

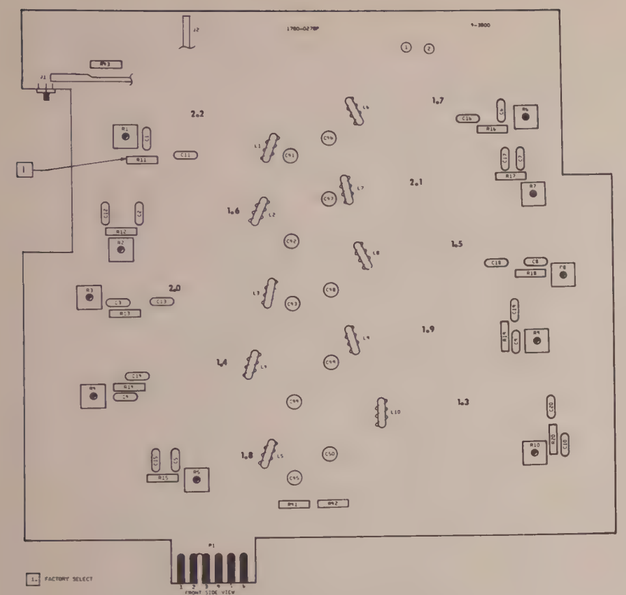
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3800	Assy, PC Bd. Osc 1300-2200 MHz	7001-0159	Cushman	
	PC Board	1780-0278	Cushman	
	CAPACITORS			
C1	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C2	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C3	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C4	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C5	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C6	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C7	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C8	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C9	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C10	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C11	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C12	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C13	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C14	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C15	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C16	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C17	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C18	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C19	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C20	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C21	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C22	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C23	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C24	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C25	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C26	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C27	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C28	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C29	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C30	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C31	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C32	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C33	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C34	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C35	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C36	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C37	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C38	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C39	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C40	Cap, 100PF, 20%, 250V Feed Thru	1005-0080	Aerovox	EF-5
C41	Plate, Single Sided Cap	2245-0043	Cushman	
C42	Plate, Single Sided Cap	2245-0043	Cushman	
C43	Plate, Single Sided Cap	2245-0043	Cushman	
C44	Plate, Single Sided Cap	2245-0043	Cushman	
C45	Plate, Single Sided Cap	2245-0043	Cushman	
C46	Plate, Single Sided Cap	2245-0043	Cushman	
C47	Plate, Single Sided Cap	2245-0043	Cushman	
C48	Plate, Single Sided Cap	2245-0043	Cushman	
C49	Plate, Single Sided Cap	2245-0043	Cushman	
C50	Plate, Single Sided Cap	2245-0043	Cushman	

1300 MHz-2200 MHz Oscillator, 3800 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	CONNECTORS			
J1	Conn, Submini RF Straight Coaxial	2536-0036	Sealectro	50-051
J2	Copper Strip	---------	Cushman	
J3	Conn, 12 Contact Double Row	2535-0052	Masterite	2MC6D/1-1
	INDUCTORS			
L1	Assy, Coil Air Core	1596-0061	Cushman	
L2	Assy, Coil Air Core	1596-0061	Cushman	
L3	Assy, Coil Air Core	1596-0061	Cushman	
L4	Assy, Coil Air Core	1596-0061	Cushman	
L5	Assy, Coil Air Core	1596-0061	Cushman	
L6	Assy, Coil Air Core	1596-0061	Cushman	
L7	Assy, Coil Air Core	1596-0061	Cushman	
L8	Assy, Coil Air Core	1596-0061	Cushman	
L9	Assy, Coil Air Core	1596-0061	Cushman	
L10	Assy, Coil Air Core	1596-0061	Cushman	
	TRANSISTORS			
Q1	Trans, 2SC1424	1272-0071	Nippon Elec	2SC1424
Q2	Trans, FMT5789	1272-0061	Fairchild	FMT5789
Q3	Trans, 2SC1424	1272-0071	Nippon Elec	2SC1424
Q4	Trans, FMT5789	1272-0061	Fairchild	FMT5789
Q5	Trans, FMT5789	1272-0061	Fairchild	FMT5789
Q6	Trans, FMT5789	1272-0061	Fairchild	FMT5789
Q7	Trans, 2SC1424	1272-0071	Nippon Elec	2SC1424
Q8	Trans, FMT5789	1272-0061	Fairchild	FMT5789
Q9	Trans, 2SC1424	1272-0071	Nippon Elec	2SC1424
Q10	Trans, FMT5789	1272-0061	Fairchild	FMT5789
	RESISTORS			
R1	Pot, 1K, 20%, 1W Trim	1200-0024	CTS	360T102B
R2	Pot, 1K, 20%, 1W Trim	1200-0024	CTS	360T102B
R3	Pot, 1K, 20%, 1W Trim	1200-0024	CTS	360T102B
R4	Pot, 1K, 20%, 1W Trim	1200-0024	CTS	360T102B
R5	Pot, 1K, 20%, 1W Trim	1200-0024	CTS	360T102B
R6	Pot, 1K, 20%, 1W Trim	1200-0024	CTS	360T102B
R7	Pot, 1K, 20%, 1W Trim	1200-0024	CTS	360T102B
R8	Pot, 1K, 20%, 1W Trim	1200-0024	CTS	360T102B
R9	Pot, 1K, 20%, 1W Trim	1200-0024	CTS	360T102B
R10	Pot, 1K, 20%, 1W Trim	1200-0024	CTS	360T102B
R11	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R12	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R13	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R14	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R15	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R16	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R17	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R18	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R19	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R20	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R21	Res, 120 Ohm, 5%, 1/4W Comp	1066-1215	Allen-Bradley	CB1215
R22	Res, 120 Ohm, 5%, 1/4W Comp	1066-1215	Allen-Bradley	CB1215
R23	Res, 120 Ohm, 5%, 1/4W Comp	1066-1215	Allen-Bradley	CB1215
R24	Res, 120 Ohm, 5%, 1/4W Comp	1066-1215	Allen-Bradley	CB1215
R25	Res, 120 Ohm, 5%, 1/4W Comp	1066-1215	Allen-Bradley	CB1215

1300 MHz-2200 MHz Oscillator, 3800 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R26	Res, 120 Ohm, 5%, 1/4W Comp	1066-1215	Allen-Bradley	CB1215
R27	Res, 120 Ohm, 5%, 1/4W Comp	1066-1215	Allen-Bradley	CB1215
R28	Res, 120 Ohm, 5%, 1/4W Comp	1066-1215	Allen-Bradley	CB1215
R29	Res, 120 Ohm, 5%, 1/4W Comp	1066-1215	Allen-Bradley	CB1215
R30	Res, 120 Ohm, 5%, 1/4W Comp	1066-1215	Allen-Bradley	CB1215
R31	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R32	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R33	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R34	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R35	Res, 100 Ohm, 5%, 1/4W C omp	1066-1015	Allen-Bradley	CB1015
R36	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R37	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R38	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R39	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R40	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R41	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R42	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R43	Res, 49.9 Ohm, 1%, 100 PPM, 1/20W	1075-0141	Dale	MFF 1/20



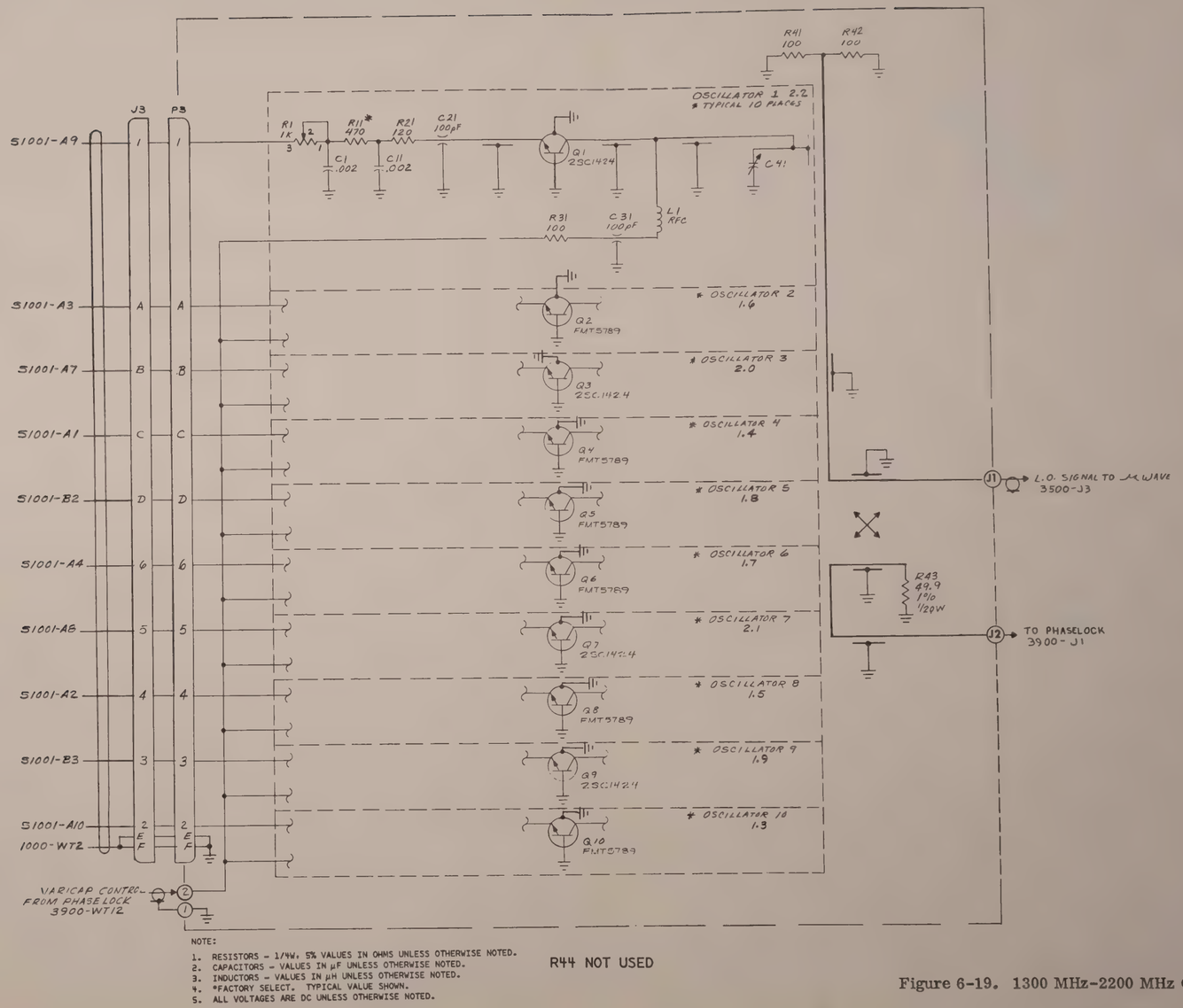


Figure 6-19. 1300 MHz-2200 MHz Oscillator, 3800

1300 MHz-2200 MHz Phase Lock, 3900

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3900	Assy, PCB Phaselock, 1300-2200 MHz	7001-0160	Cushman	
	PC Board	1780-0274	Cushman	
	CAPACITORS			
C1	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C2	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C3	Cap, 5PF, .5PF%, 500V Mica	1002-0028	Elmenco	DM15-C-050D
C4	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C5	Cap, 1.5μF, 10%, 35V	1013-0001	Sprague	150D155X9035B2
C6	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C7	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C8	Cap, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C9	Cap, 10μF, 10%, 20V	1011-0007	Kemet	K10C20K
C10	Cap, .047μF, 10%, 100V	1008-0049	Sprague	225P12391WA3
C11	Cap, 10μF, 10%, 20V	1011-0007	ITT	TAG 10/35-20
C12	Cap, 3.3μF, 10%, 15V	1011-0008	Sprague	225P33291WA3
C13	Cap, 56PF, 5%, 500V Mica	1002-0019	Elmenco	DM15-E-560J
C14	Cap, 5.5-18PF, 350V Vert Trim	1001-0008	Erie	538-002A-5.5-18
C15	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C16	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C17	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C18	Cap, 180PF, 5%, 500V Mica	1002-0005	Elmenco	DM15-F-181J
C19	Cap, 180PF, 5%, 500V Mica	1002-0005	Elmenco	DM15-F-181J
C20	Cap, 9-35PF, 200V Vert Trim	1001-0006	Erie	538-002-94D
C21	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C22	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C23	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C24	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C25	Cap, 180PF, 5%, 500V Mica	1002-0005	Elmenco	DM15-F-181J
C26	Cap, 36PF, 5%, 500V Mica	1002-0041	Elmenco	DM15-E-360J
C27	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C28	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C29	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C30	Cap, 100PF, 5%, 100V Min Cer	1005-0082	Erie	8121-100-C0G-101K
C31	Cap, 1000PF, 10%, 100V Min Cer	1005-0081	Erie	8121-100-W5R-102K
C32	Cap, 220PF, 10%, 100V Mini	1005-0075	Erie	8101-A100-W5R0-221K
C33	Cap, 100PF, 5%, 100V Min Cer	1005-0082	Erie	8121-100-C0G-101K
C34	Cap, 100PF, 5%, 100V Min Cer	1005-0082	Erie	8121-100-C0G-101K
C35	Cap, 100PF, 5%, 100V Min Cer	1005-0082	Erie	8121-100-C0G-101K
C36	Cap, 4.7PF, .25PF%, 50V	1012-0009	Varadyne	3BN050S4R7C(S)
C37	Cap, 100PF, 5%, 100V Min Cer	1005-0082	Erie	8121-100-C0G-101K
C38	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C39	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C40	Cap, 1000PF, 10%, 100V Min Cer	1005-0081	Erie	8121-100-W5R-102K
C41	Cap, 100PF, 5%, 500V Mica	1002-0011	Elmenco	DM15-F-101J
C42	Cap, 12PF, 5%, 500V Mica	1002-0017	Elmenco	DM15-C-120J
C43	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C44	Cap, 820PF, 5%, 300V Mica	1002-0039	Elmenco	DM15-F-821J
C45	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C46	Cap, 560PF, 5%, 300V Mica	1002-0037	Elmenco	DM15-F-561J
C47	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C48	Cap, 10μF, +100-10%, 25V Elctlt Rdl	1013-0035	Sprague	503D106G025AS

1300 MHz-2200 MHz Phase Lock, 3900 (cont)

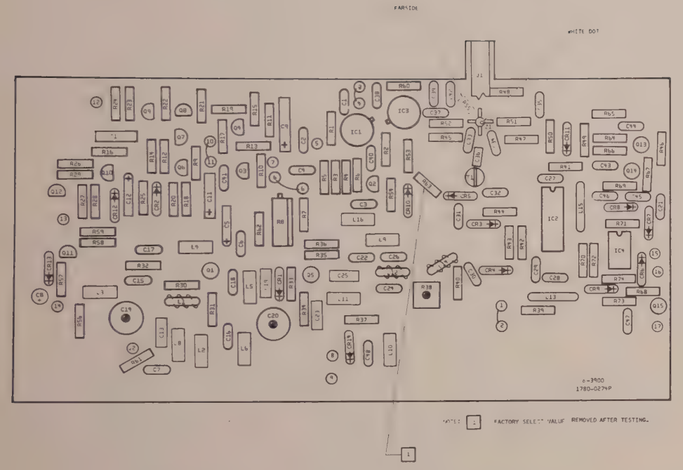
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	DIODES			
CR1	Diode, Microwave Pin, 1SV34	1281-0075	Nippon Elec	1SV34
CR2	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR3	Diode, HPA0136	1282-0006	HP	5082-0136
CR4	Diode, HPA2811	1283-0004	HP	5082-2811
CR5	Diode, HPA2811	1283-0004	HP	5082-2811
CR6	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR7	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR8	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR9	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR10	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR11	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR12	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR13	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR14	Diode, 1N3064	1281-0013	Teledyne	1N3064
	INDUCTORS			
L1	Assy, Coil, .064μH, RF	1596-5802	Cushman	
L2	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L3	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L4	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L5	Choke, .22μH, 20%	1585-0039	Delevan	1537-02
L6	Choke, .1μH	1585-0041	Delevan	2307-101
L7	Not Used			
L8	Choke, 2.2μH, 10%	1585-0013	Delevan	1537-20
L9	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L10	Choke, 2 1/2 Turns Wide Band	1586-0003	VK	20020/4B
L11	Choke, 1.5μH, 10%	1585-0038	Delevan	1537-16
L12	Assy, Coil, .131μH	1596-5805	Cushman	
L13	Choke, 2.2μH, μ0%	1585-0013	Delevan	1537-20
L14	Assy, Coil, .064μH RF	1596-5802	Cushman	
L15	Choke, 2.2μH, 10%	1585-0013	Delevan	1537-20
L16	Choke, 2.2μH, 10%	1585-0013	Delevan	1537-20
	TRANSISTORS			
Q1	Trans, 2N3643	1272-0066	Fairchild	2N3643
Q2	Trans, 2N3906	1272-0037	Motorola	2N3906
Q3	Trans, 2N5089	1272-0031	Motorola	2N5089
Q4	Trans, 2N5089	1272-0031	Motorola	2N5089
Q5	Trans, 2N3866	1271-0005	RCA	2N3866
Q6	Trans, 2N3904	1272-0032	Motorola	2N3904
Q7	Trans, 2N3904	1272-0032	Motorola	2N3904
Q8	Trans, 2N3906	1272-0037	Motorola	2N3906
Q9	Trans, 2N3904	1272-0032	Motorola	2N3904
Q10	Trans, 2N3906	1272-0037	Motorola	2N3906
Q11	Trans, 2N3904	1272-0032	Motorola	2N3904
Q12	Trans, 2N3904	1272-0032	Motorola	2N3904
Q13	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q14	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q15	Trans, 2N4393	1272-0055	Teledyne	2N4393

1300 MHz-2200 MHz Phase Lock, 3900 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	RESISTORS			
R1	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R2	Res, 1.2K, 5%, 1/4W Comp	1066-1225	Allen-Bradley	CB1225
R3	Res, 75 Ohm, 1%, 1/8W MF	1075-0035	Dale	MFF 1/8
R4	Res, 2.43K, 1%, 1/8W MF	1075-0019	Dale	MFF 1/8
R5	Res, 5.6K, 5%, 1/4W Comp	1066-5625	Allen-Bradley	CB5625
R6	Res, 56 Ohm, 5%, 1/4W Comp	1066-5605	Allen-Bradley	CB5605
R7	Res, 1.8K, 5%, 1/4W Comp	1066-1825	Allen-Bradley	CB1825
R8	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R9	Res, 12K, 5%, 1/4W Comp	1066-1235	Allen-Bradley	CB1235
R10	Res, 1.3K, 5%, 1/4W Comp	1066-1325	Allen-Bradley	CB1325
R11	Res, 3.6K, 5%, 1/4W Comp	1066-3625	Allen-Bradley	CB3625
R12	Res, 3.3K, 5%, 1/4W C omp	1066-3325	Allen-Bradley	CB3325
R13	Res, 1.1K, 5%, 1/4W Comp	1066-1125	Allen-Bradley	CB1125
R14	Res, 18K, 5%, 1/4W Comp	1066-1835	Allen-Bradley	CB1835
R15	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R16	Res, 43 Ohm, 5%, 1/4W Comp	1066-4305	Allen-Bradley	CB4305
R17	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R18	Res, 5.6K, 5%, 1/4W Comp	1066-5625	Allen-Bradley	CB5625
R19	Res, 8.2K, 5%, 1/4W Comp	1066-8225	Allen-Bradley	CB8225
R20	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R21	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R22	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R23	Res, 270 Ohm, 5%, 1/4W Comp	1066-2715	Allen-Bradley	CB2715
R24	Res, 5.6K, 5%, 1/4W Comp	1066-5625	Allen-Bradley	CB5625
R25	Res, 75K, 5%, 1/4W Comp	1066-7535	Allen-Bradley	CB7535
R26	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R27	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R28	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R29	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R30	Res, 5.6K, 5%, 1/4W Comp	1066-5625	Allen-Bradley	CB5625
R31	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R32	Res, 680 Ohm, 5%, 1/2W Comp	1067-6815	Allen-Bradley	EB6815
R33	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R34	Res, 15 Ohm, 5%, 1/4W Comp	1066-1505	Allen-Bradley	CB1505
R35	Res, 3.9K, 5%, 1/4W Comp	1066-3925	Allen-Bradley	CB3925
R36	Res, 8.2K, 5%, 1/4W Comp	1066-8225	Allen-Bradley	CB8225
R37	Res, 390 Ohm, 5%, 1/2W Comp	1067-3915	Allen-Bradley	EB3915
R38	Pot, 20K, 20%, 1W Trim	1200-0028	CTS	360T203B
R39	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R40	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R41	Res, 10 Meg, 5%, 1/4W Comp	1066-1065	Allen-Bradley	CB1065
R42	Res, 18K, 5%, 1/4W Comp	1066-1835	Allen-Bradley	CB1835
R43	Res, 22K, 5%, 1/4W Comp	1066-2235	Allen-Bradley	CB2235
R44	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R45	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R46	Res, 200 Ohm, 5%, 1/4W Comp	1066-2015	Allen-Bradley	CB2015
R47	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R48	Res, 49.9 Ohm, 1%, 100 PPM, 1/20W	1075-0141	Dale	MFF 1/20
R49	Res, 1.8K, 5%, 1/4W Comp	1066-1825	Allen-Bradley	CB1825
R50	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025

1300 MHz-2200 MHz Phase Lock, 3900 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R51	Res, 220 Ohm, 5%, 1/4W Comp	1066-2215	Allen-Bradley	CB2215
R52	Res, 220 Ohm, 5%, 1/4W Comp	1066-2215	Allen-Bradley	CB2215
R53	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R54	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R55	Res, 4.3K, 5%, 1/4W Comp	1066-4325	Allen-Bradley	CB4325
R56	Res, 470K, 5%, 1/4W Comp	1066-4745	Allen-Bradley	CB4745
R57	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R58	Res, 4.7K, 5%, 1/4W Comp	1066-4725	Allen-Bradley	CB4725
R59	Res, 3.9K, 5%, 1/4W Comp	1066-3925	Allen-Bradley	CB3925
R60	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R61	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R62	Res, 10 Ohm, 5%, 1/4W Comp	1066-1005	Allen-Bradley	CB1005
R63	Res, FSV 5%, 1/4W Comp	1066-XXXX	Allen-Bradley	CBXXXX
R64	Res, 18K, 5%, 1/4W Comp	1066-1835	Allen-Bradley	CB1835
R65	Res, 4.3K, 5% , 1/4W Comp	1066-4325	Allen-Bradley	CB4325
R66	Res, 1.6K, 5%, 1/4W Comp	1066-1625	Allen-Bradley	CB1625
R67	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R68	Res, 270K, 5%, 1/4W Comp	1066-2745	Allen-Bradley	CB2745
R69	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R70	Res, 3.3K, 5%, 1/4W Comp	1066-3325	Allen-Bradley	CB3325
R71	Res, 36K, 5%, 1/4W Comp	1066-3635	Allen-Bradley	CB3635
R72	Res, 2.4K, 5%, 1/4W Comp	1066-2425	Allen-Bradley	CB2425
R73	Res, 7.5K, 5%, 1/4W Comp	1066-7525	Allen-Bradley	CB7525
R74	Res, 5.6K, 5%, 1/4W Comp	1066-5625	Allen-Bradley	CB5625
	TRANSFORMER			
T1	Assy, Transformer Toroidal Bifilar	1579-0027	Cushman	
	INTEGRATED CIRCUITS			
U1	IC, CA3028B	2025-0061	RCA	CA3028B
U2	IC, 72741, 14 Pin Hi Perform Op Amp	2025-0022	TI	SN72741N
U3	IC, LM302 Voltage Follower	2025-0029	National	LM302H
U4	IC, SN72741P	2025-0067	TI	SN72741P
	BRIDGE RECTIFIER			
Z1	Bridge Quad	1281-0067	HPA	HPA2206



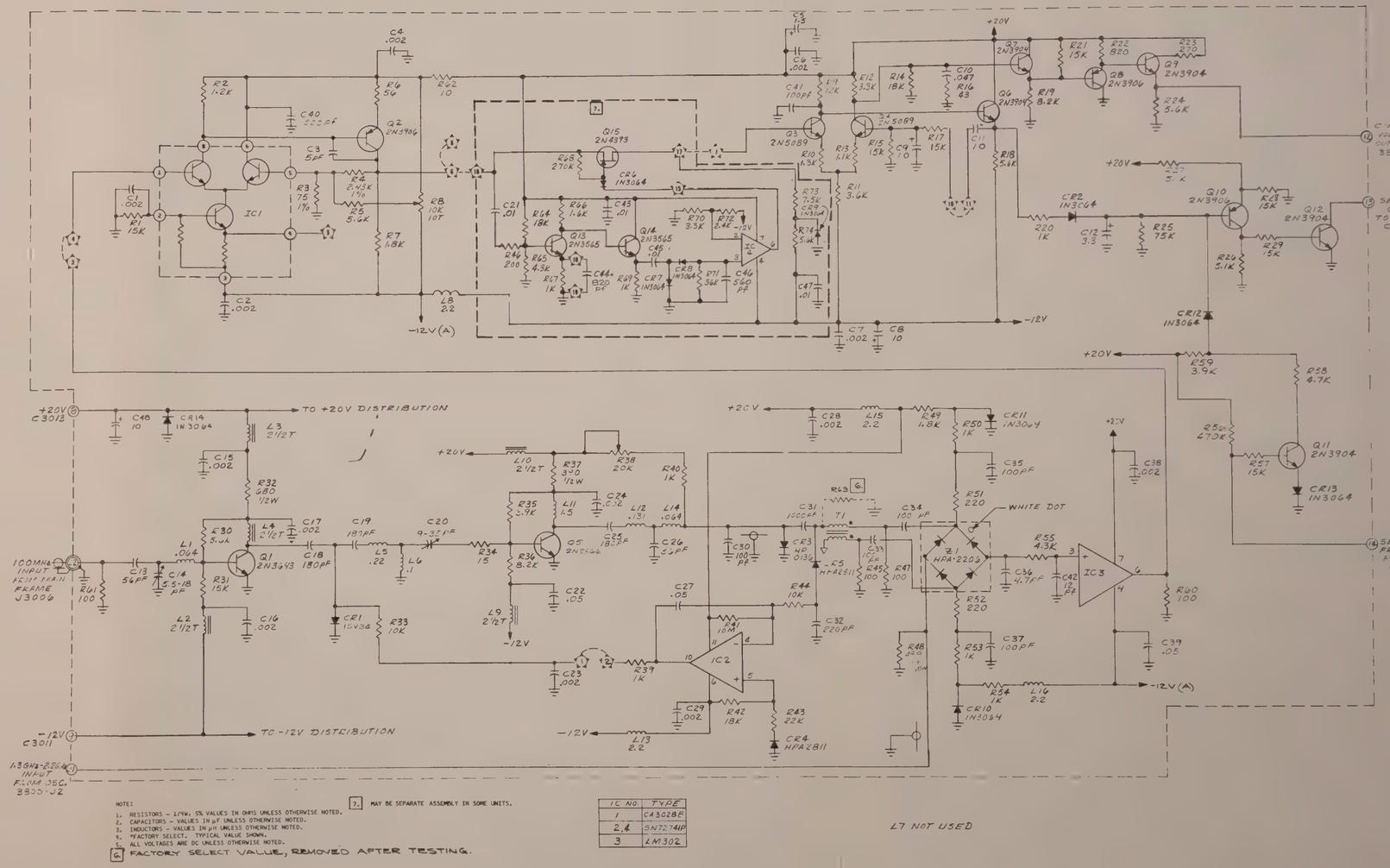


Figure 6-20. 1300 MHz-2200 MHz Phase Lock, 3900

10 MHz Modulator and Switch Logic, 4400

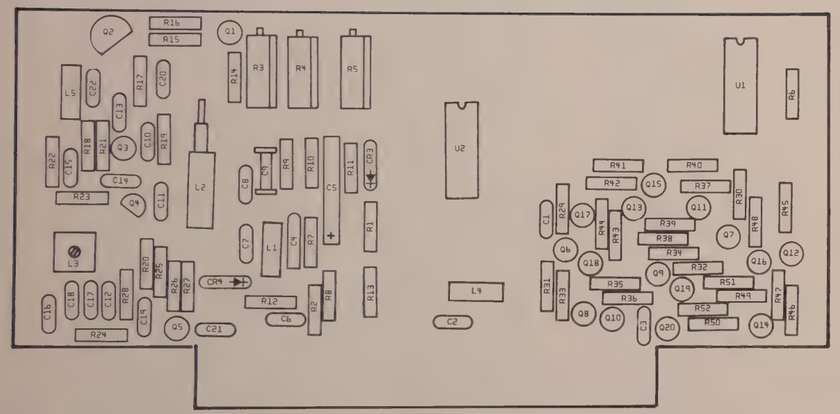
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
4400	PCB Assy, 10 MHz Mod & Sw Logic	7001-0442	Cushman	
	PC Board	1780-0710	Cushman	
	CAPACITORS			
C1	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C2	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C3	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C4	Cap, .027μF, 10%, 100V	1008-0032	Sprague	225P27391
C5	Cap, 1MF 50V DC 10% Electrolytic	1013-0004	Sprague	30D105G025BA5
C6	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C7	Cap, 180PF, 5%, 500V Mica	1002-0005	Elmenco	DM15-F-181J
C8	Cap, 22PF, 5%, 500V Mica	1002-0023	Elmenco	DM15-C-220J
C9	Cap, 22PF, 2%, 500V Tub.	1005-0007	Erie	301-000-U2J0-220G
C10	Cap, 470PF, 5%, 500V Mica	1002-0035	Elmenco	DM15-F-471J
C11	Cap, 470PF, 5%, 500V Mica	1002-0035	Elmenco	DM15-F-471J
C12	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C13	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C14	Cap, 30PF, 5%, 500V Mica	1002-0043	Elmenco	DM15-E-300J
C15	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C16	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C17	Cap, 39PF, 5%, 500V Mica	1002-0018	Elmenco	DM15-E-390J
C18	Cap, 390PF, 5%, 500V Mica	1002-0033	Elmenco	DM15-F-391J
C19	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C20	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C21	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C22	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
	DIODES			
CR1	Not used			
CR2	Not used			
CR3	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR4	Diode, V33	1281-0010	TRW	V33
	INDUCTORS			
L1	Choke, 82μH, 5%	1585-0032	Delevan	1537-72
L2	Coil, 3.8 to 7.3μH	1596-0025	Delevan	4000-18
L3	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L4	Choke, 82μH, 5%	1585-0032	Delevan	1537-72
L5	Choke, 82μH, 5%	1585-0032	Delevan	1537-72
	TRANSISTORS			
Q1	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q2	Trans, 2N3638	1272-0015	Fairchild	2N3638
Q3	Trans, 2N4275	1272-0016	Fairchild	2N4275
Q4	Trans, 2N3906	1272-0037	Motorola	2N3906
Q5	Trans, 2N4275	1272-0016	Fairchild	2N4275
Q6	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q7	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q8	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q9	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q10	Trans, 2N3565	1272-0017	Fairchild	2N3565

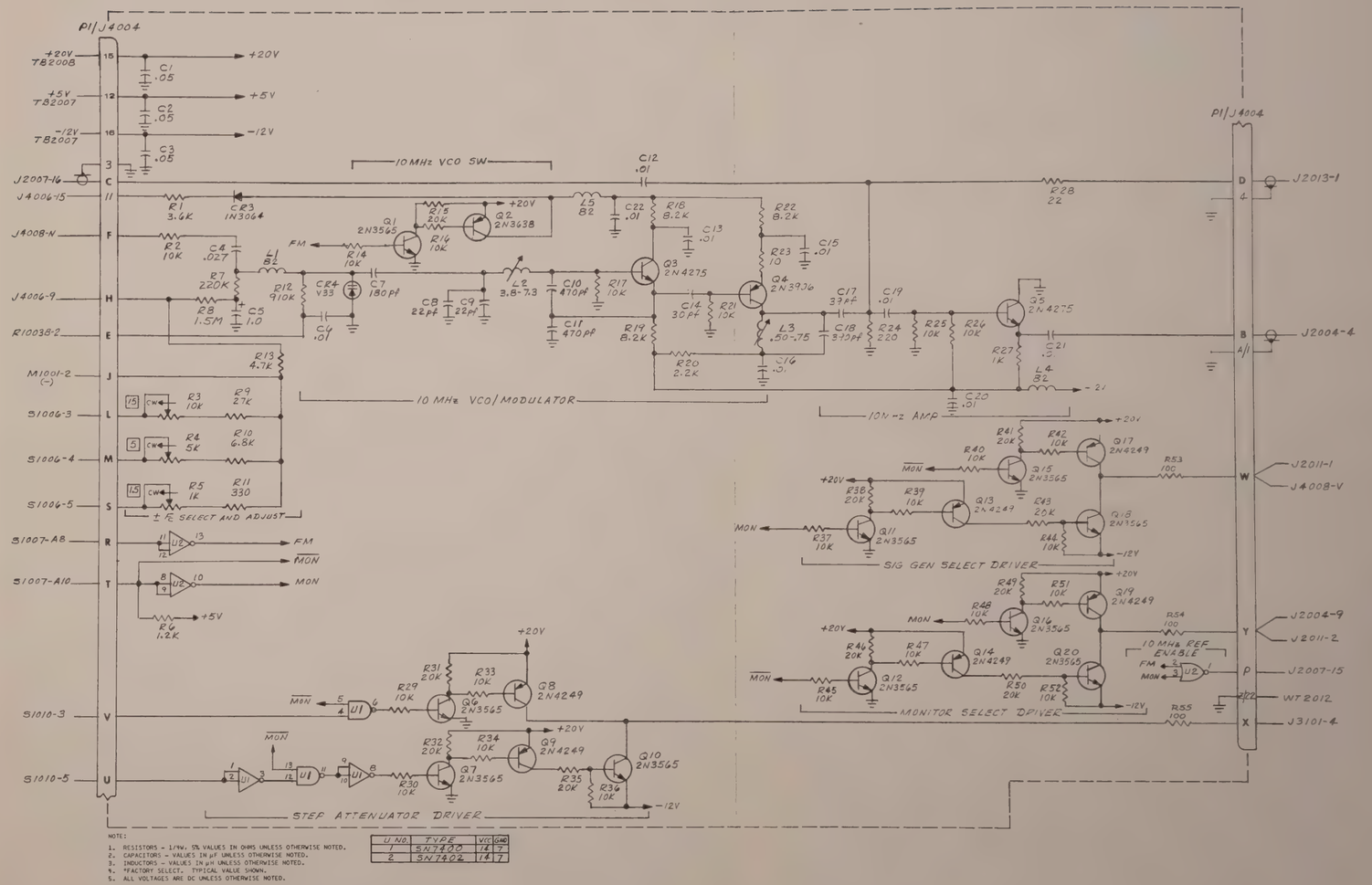
10 MHz Modulator and Switch Logic, 4400 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
Q11	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q12	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q13	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q14	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q15	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q16	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q17	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q18	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q19	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q20	Trans, 2N3565	1272-0017	Fairchild	2N3565
	RESISTORS			
R1	Res, 3.6K, 5%, 1/4W Comp	1066-3625	Allen-Bradley	CB3625
R2	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R3	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R4	Pot, 5K, 10%, 3/4W	1215-0012	Helitrim	89WR
R5	Pot, 1K, 10%, 3/4W	1215-0013	Helitrim	89WR
R6	Res, 1.2K, 5%, 1/4W Comp	1066-1225	Allen-Bradley	CB1225
R7	Res, 220K, 5%, 1/4W Comp	1066-2245	Allen-Bradley	CB2245
R8	Res, 1.5 Meg, 5%, 1/4W Comp	1066-1555	Allen-Bradley	CB1555
R9	Res, 27K, 5%, 1/4W Comp	1066-2735	Allen-Bradley	CB2735
R10	Res, 6.8K, 5%, 1/4W Comp	1066-6825	Allen-Bradley	CB6825
R11	Res, 330 Ohm, 5%, 1/4W Comp	1066-3315	Allen-Bradley	CB3315
R12	Res, 910K, 5%, 1/4W Carbon Comp	1066-9145	Allen-Bradley	CB9145
R13	Res, 4.7K, 5%, 1/4W Comp	1066-4725	Allen-Bradley	CB4725
R14	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R15	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R16	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R17	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R18	Res, 8.2K, 5%, 1/4W Comp	1066-8225	Allen-Bradley	CB8225
R19	Res, 8.2K, 5%, 1/4W Comp	1066-8225	Allen-Bradley	CB8225
R20	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R21	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R22	Res, 8.2K, 5%, 1/4W Comp	1066-8225	Allen-Bradley	CB8225
R23	Res, 10 Ohm, 5%, 1/4W Comp	1066-1005	Allen-Bradley	CB1005
R24	Res, 220 Ohm, 5%, 1/4W Comp	1066-2215	Allen-Bradley	CB2215
R25	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R26	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R27	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R28	Res, 22 Ohm, 5%, 1/4W Comp	1066-2205	Allen-Bradley	CB2205
R29	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R30	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R31	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R32	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R33	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R34	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R35	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R36	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R37	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R38	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R39	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R40	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035

10 MHz Modulator and Switch Logic, 4400 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R41	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R42	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R43	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R44	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R45	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R46	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R47	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R48	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R49	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R50	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R51	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R52	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R53	Res, 100Ω, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R54	Res, 100Ω, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R55	Res, 100Ω, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
	INTEGRATED CIRCUITS			
U1	IC, SN7400N, TTL Nand Gates	2025-0003	TI	SN7400N
U2	IC, SN7402, Quad 2 Inpt Pos Nor Gate	2025-0059	TI	SN7402N





5601**0065**2

Figure 6-21. 10 MHz Modulator/Switching Logic, 4400

Second I. F./Discriminator, 4600

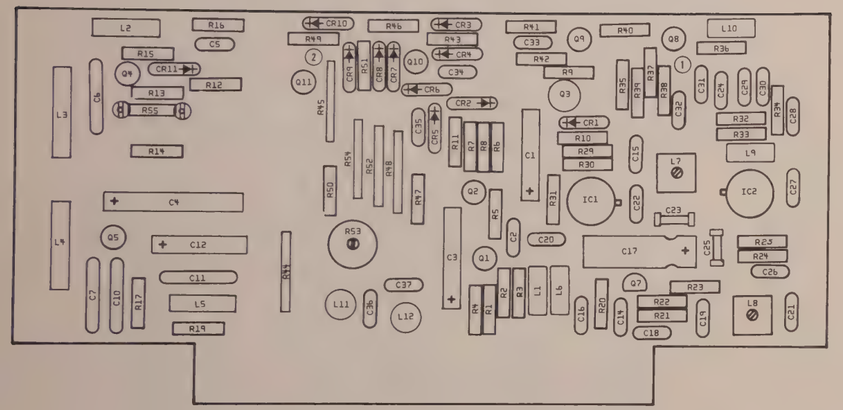
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
4600	PCB Assy, Second IF/Discriminator	7001-0400	Cushman	
	PC Board	1780-0525	Cushman	
	CAPACITORS			
C1	Cap, 15μF, 10%, 25V	1013-0005	Sprague	30D156G025BB5
C2	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C3	Cap, 15μF, 10%, 25V	1013-0005	Sprague	30D156G025BB5
C4	Cap, 470 OR, 500μF, 25V Elctlt	1014-0020	Ill. Cap.	25T470
C5	Cap, 470PF, 5%, 500V Mica	1002-0035	Elmenco	DM15-F-471J
C6	Cap, .027μF, 10%, 100V	1008-0032	Sprague	225P27391
C7	Cap, .027μF, 10%, 100V	1008-0032	Sprague	225P27391
C8	Not Used			
C9	Not Used			
C10	Cap, .027μF, 10%, 100V	1008-0032	Sprague	225P27391
C11	Cap, .027μF, 10%, 100V	1008-0032	Sprague	225P27391
C12	Cap, 15μF, 10%, 25V	1013-0005	Sprague	30D156G025BB5
C13	Not Used			
C14	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C15	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C16	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C17	Cap, 100μF, +75-10%, 12V	1013-0011	Sprague	30D107G012CC5
C18	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C19	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C20	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C21	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C22	Cap, 430PF, 5%, 500V Mica	1002-0034	Elmenco	DM15-F-431J
C23	Cap, 3.3PF, .25PF%, 500V Tub.	1005-0011	Erie	301-000-C0J0-339C
C24	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C25	Cap, 2.2PF, .25PF%, 500V Tub.	1005-0017	Erie	301-000-C0J0-229C
C26	Cap, 430PF, 5%, 500V Mica	1002-0034	Elmenco	DM15-F-431J
C27	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C28	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C29	Cap, 470PF, 5%, 500V Mica	1002-0035	Elmenco	DM15-F-471J
C30	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C31	Cap, 470PF, 5%, 500V Mica	1002-0035	Elmenco	DM15-F-471J
C32	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C33	Cap, 100PF, 5%, 500V Mica	1002-0011	Elmenco	DM15-F-101J
C34	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C35	Cap, 470PF, 1%, 500V Mica	1002-0044	Elmenco	DM15-F-471F
C36	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C37	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
	DIODES			
CR1	Diode, G633	1282-0005	ITT	G633
CR2	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR3	Diode, G633	1282-0005	ITT	G633
CR4	Diode, G633	1282-0005	ITT	G633
CR5	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR6	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR7	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR8	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR9	Diode, G633	1282-0005	ITT	G633
CR10	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR11	Diode, 1N3064	1281-0013	Teledyne	1N3064

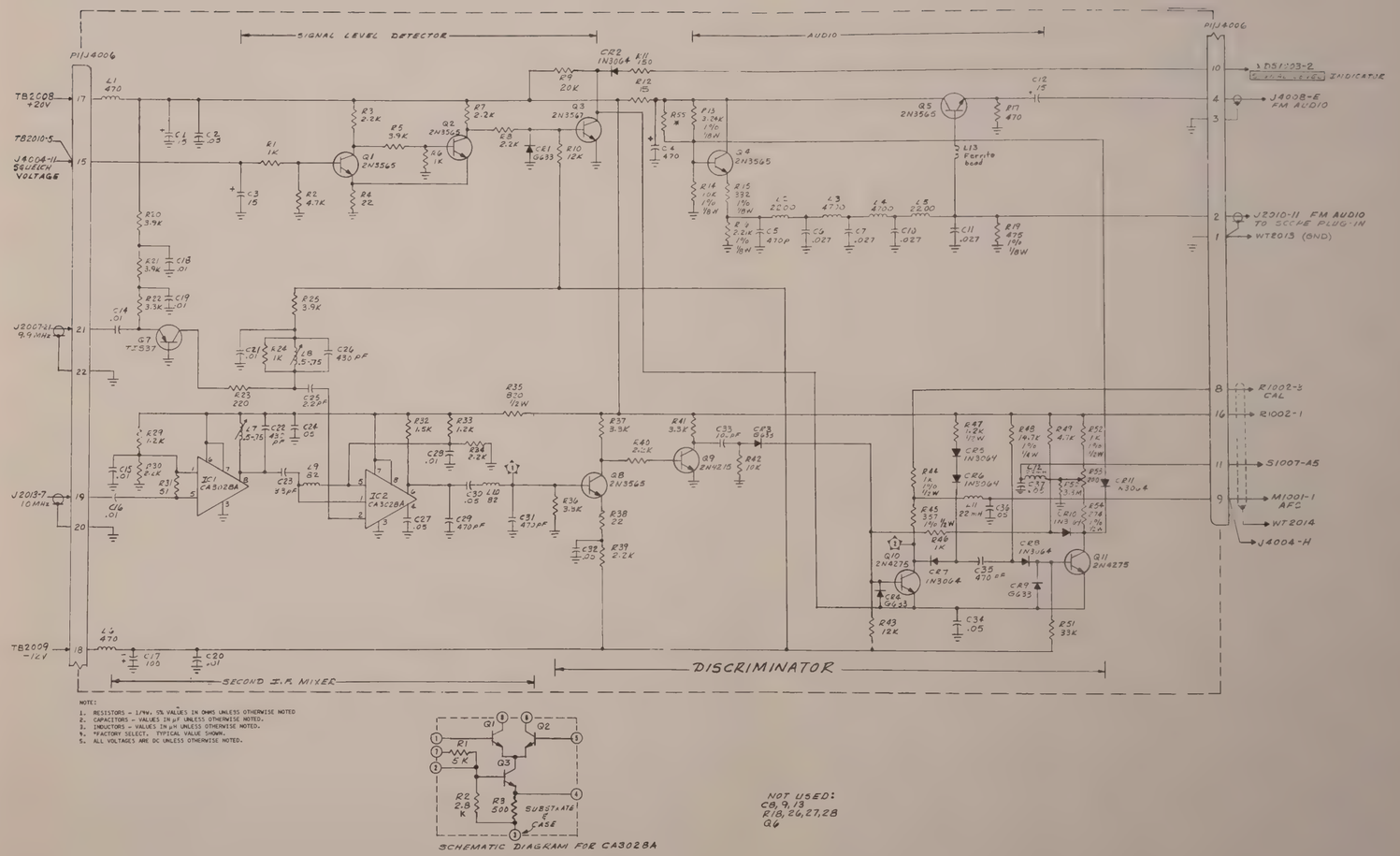
Second I. F./Discriminator, 4600 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	INDUCTORS			
L1	Choke, 470μH, 5%	1585-0019	Delevan	2500-12
L2	Choke, 2200μH, 5%	1585-0030	Delevan	2500-44
L3	Choke, 4700μH, 5%	1585-0006	Delevan	2500-60
L4	Choke, 4700μH, 5%	1585-0006	Delevan	2500-60
L5	Choke, 2200μH, 5%	1585-0030	Delevan	2500-44
L6	Choke, 470μH, 5%	1585-0019	Delevan	2500-12
L7	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L8	Coil, 8 Turn 16 MHz	1596-0111	Cushman	
L9	Choke, 82μH, 5%	1585-0032	Delevan	1537-72
L10	Choke, 82μH, 5%	1585-0032	Delevan	1537-72
L11	Choke, 22MH, 15%	1585-0029	Delevan	2534-56
L12	Choke, 22MH, 15%	1585-0029	Delevan	2534-56
L13	Choke, U-250 Ferrite bead	1586-0004	Ferroxcube	56-590-65/4B
	TRANSISTORS			
Q1	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q2	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q3	Trans, 2N3567	1272-0014	Fairchild	2N3567
Q4	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q5	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q6	Not Used			
Q7	Trans, TIS 37	1271-0003	TI	TIS37
Q8	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q9	Trans, 2N4275	1272-0016	Fairchild	2N4275
Q10	Trans, 2N4275	1272-0016	Fairchild	2N4275
Q11	Trans, 2N4275	1272-0016	Fairchild	2N4275
	RESISTORS			
R1	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R2	Res, 4.7K, 5%, 1/4W Comp	1066-4725	Allen-Bradley	CB4725
R3	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R4	Res, 22 Ohm, 5%, 1/4W Comp	1066-2205	Allen-Bradley	CB2205
R5	Res, 3.9K, 5%, 1/4W Comp	1066-3925	Allen-Bradley	CB3925
R6	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R7	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R8	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R9	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R10	Res, 12K, 5%, 1/4W Comp	1066-1235	Allen-Bradley	CB1235
R11	Res, 150 Ohm, 5%, 1/4W Comp	1066-1515	Allen-Bradley	CB1515
R12	Res, 15 Ohm, 5%, 1/4W Comp	1066-1505	Allen-Bradley	CB1505
R13	Res, 3.24K, 1%, 1/8W MF	1075-0092	Dale	MFF 1/8
R14	Res, 10K, 1%, 1/8W MF	1075-0009	Dale	MFF 1/8
R15	Res, 332 Ohm, PPM Metal Film	1075-0024	Dale	MFF 1/8
R16	Res, 2.21K, 1%, 1/8W MF	1075-0010	Dale	MFF 1/8
R17	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R18	Not Used			
R19	Res, 475 Ohm, PPM Metal Film	1075-0023	Dale	MFF 1/8
R20	Res, 3.9K, 5%, 1/4W Comp	1066-3925	Allen-Bradley	CB3925
R21	Res, 3.9K, 5%, 1/4W Comp	1066-3925	Allen-Bradley	CB3925
R22	Res, 3.3K, 5%, 1/4W Comp	1066-3325	Allen-Bradley	CB3325
R23	Res, 220 Ohm, 5%, 1/4W Comp	1066-2215	Allen-Bradley	CB2215
R24	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R25	Res, 3.9K, 5%, 1/4W Comp	1066-3925	Allen-Bradley	CB3925

Second I. F./Discriminator, 4600 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R26	Not Used			
R27	Not Used			
R28	Not Used			
R29	Res, 1.2K, 5%, 1/4W Comp	1066-1225	Allen-Bradley	CB1225
R30	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R31	Res, 51 Ohm, 5%, 1/4W Comp	1066-5105	Allen-Bradley	CB5105
R32	Res, 1.5K, 5%, 1/4W Comp	1066-1525	Allen-Bradley	CB1525
R33	Res, 1.2K, 5%, 1/4W Comp	1066-1225	Allen-Bradley	CB1225
R34	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R35	Res, 820 Ohm, 5%, 1/2W Comp	1067-8215	Allen-Bradley	EB8215
R36	Res, 3.3K, 5%, 1/4W Comp	1066-3325	Allen-Bradley	CB3325
R37	Res, 3.3K, 5%, 1/4W Comp	1066-3325	Allen-Bradley	CB3325
R38	Res, 22 Ohm, 5%, 1/4W Comp	1066-2205	Allen-Bradley	CB2205
R39	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R40	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R41	Res, 3.3K, 5%, 1/4W Comp	1066-3325	Allen-Bradley	CB3325
R42	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R43	Res, 12K, 5%, 1/4W Comp	1066-1235	Allen-Bradley	CB1235
R44	Res, 1K, 1%, 1/2W MF	1076-0007	Dale	MFF 1/2 T1
R45	Res, 357 Ohm, 1%, 1/2W MF	1076-0012	Electra	MF7C-D-3750-F
R46	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R47	Res, 1.2K, 5%, 1/2W Comp	1067-1225	Allen-Bradley	EB1225
R48	Res, 14.7K, 1%, 1/4W MF	1077-0002	Electra	MF6C-D-1472-F
R49	Res, 4.7K, 5%, 1/4W Comp	1066-4725	Allen-Bradley	CB4725
R50	Res, 3.3M, 5%, 1/4W Comp	1066-3355	Allen-Bradley	CB3355
R51	Res, 33K, 5%, 1/4W Comp	1066-3335	Allen-Bradley	CB3335
R52	Res, 1K, 1%, 1/2W MF	1076-0007	Electra	MF7C-D-1001-F
R53	Pot, 200 Ohm, 10%, 1/4W Trim	1200-0016	Allen-Bradley	F-FR201U
R54	Res, 274 Ohm, 1%, 1/2W MF	1076-0013	Electra	MF7C-D-2740-F
R55	Res, FSV, 5%, 1/4W Comp	1066-xxxx	Allen-Bradley	CBxxxx
	INTEGRATED CIRCUITS			
U1	IC, CA3028A, RF Amp	2025-0012	RCA	CA3028A
U2	IC, CA3028A, RF Amp	2025-0012	RCA	CA3028A





NOTE:
1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

SCHEMATIC DIAGRAM FOR CA3028A

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Figure 6-22. Second I. F./Discriminator, 4600

Audio Amplifier and Varactor Control, 4800

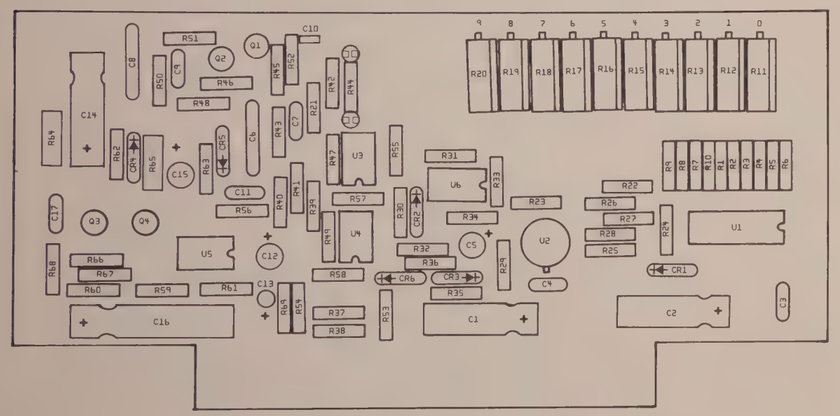
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
4800	PCB Assy, Audio Amp. & Varactor Control	7001-0379	Cushman	
	PC Board	1780-0711	Cushman	
	CAPACITORS			
C1	Cap, 100μF, 10%, 25V	1013-0003	Sprague	30D107G025DD5
C2	Cap, 100μF, 10%, 25V	1013-0003	Sprague	30D107G025DD5
C3	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C4	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C5	Cap, 100μF, 20%, 20V	1011-0010	Kemet	T362D107M020AS
C6	Cap, .1μF, 10%, 100V	1008-0031	Sprague	225P10491WA3
C7	Cap, .01μF, 10%, 200V	1005-0065	Aerovox	CK06BX103K
C8	Cap, .1μF, 10%, 100V	1008-0031	Sprague	225P10491WA3
C9	Cap, .01μF, 10%, 200V	1005-0065	Aerovox	CK06BX103K
C10	Cap, .047μF, 20%, 100V Mini	1005-0096	Erie	8121-100-651-473M
C11	Cap, 100PF, 5%, 500V Mica	1002-0011	Elmenco	DM15-F-101J
C12	Cap, 100μF, 20%, 20V	1011-0010	Kemet	T362D107M020AS
C13	Cap, .047μF,10%, 35V	1005-0096	Erie	8121-100-651-473M
C14	Cap, 100μF, 10%, 25V	1013-0003	Sprague	30D107G025DD5
C15	Cap, 100μF, 20%, 20V	1011-0010	Kemet	T363D107M020AS
C16	Cap, 250μF, +75-10%, 16V	1013-0016	Sprague	30D57G016DF2
C17	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
	DIODES			
CR1	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR2	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR3	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR4	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR5	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR6	Diode, 1N4733	1281-0015	Motorola	1N4733
	TRANSISTORS			
Q1	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q2	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q3	Trans, 2N3642	1272-0018	Fairchild	2N3642
Q4	Trans, 2N3644	1272-0040	Fairchild	2N3644
	RESISTORS			
R1	Res, 5.1K,5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R2	Res, 3 K, 5%, 1/4W #3	1066-3025	Allen-Bradley	CB3025
R3	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R4	Res, 4.7K, 5%, 1/4W Comp	1066-4725	Allen-Bradley	CB4725
R5	Res, 5.6K, 5%, 1/4W Comp	1066-5625	Allen-Bradley	CB5625
R6	Res, 3K, 5%, 1/4W Comp	1066-3025	Allen-Bradley	CB3025
R7	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R8	Res, 3.9K, 5%, 1/4W Comp	1066-3925	Allen-Bradley	CB3925
R9	Res, 3.3K, 5%, 1/4W Comp	1066-3325	Allen-Bradley	CB3325
R10	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R11	Pot, 50K, 10%, 3/4W	1215-0023	Beckman	89WR
R12	Pot, 50K, 10%, 3/4W	1215-0023	Beckman	89WR
R13	Pot, 50K, 10%, 3/4W	1215-0023	Beckman	89WR
R14	Pot, 50K, 10%, 3/4W	1215-0023	Beckman	89WR
R15	Pot, 20K, 10%, 3/4W	1215-0021	Beckman	89WR

Audio Amplifier and Varactor Control, 4800 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R16	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R17	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R18	Pot, 5K, 10%, 3/4W	1215-0012	Helitrim	89WR
R19	Pot, 5K, 10%, 3/4W	1215-0012	Helitrim	89WR
R20	Pot, 5K, 10%, 3/4W	1215-0012	Helitrim	89WR
R21	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R22	Res, 10K, 1%, 1/8W MF	1075-0009	Dale	MFF 1/8
R23	Res, 10K, 1%, 1/8W MF	1075-0009	Dale	MFF 1/8
R24	Res, 43K, 5%, 1/4W Carbon Comp	1066-4335	Allen-Bradley	CB4335
R25	Res, 470K, 5%, 1/4W Comp	1066-4745	Allen-Bradley	CB4745
R26	Res, 910K, 5%, 1/4W Carbon Comp	1066-9145	Allen-Bradley	CB9145
R27	Res, 200K, 5%, 1/4W Comp	1066-2045	Allen-Bradley	CB2045
R28	Res, 16.9K, 1%, 1/8W	1075-0059	Dale	MFF 1/8
R29	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R30	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R31	Res, 30K, 5%, 1/4W Carbon Comp	1066-3035	Allen-Bradley	CB3035
R32	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R33	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R34	Res, 100K, 5%, 1/4W Comp	1066-1045	Allen-Bradley	CB1045
R35	Res, 560 Ohm, 5%, 1/4W Comp	1066-5615	Allen-Bradley	CB5615
R36	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R37	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R38	Res, 1.1K, 5%, 1/4W Comp	1066-1125	Allen-Bradley	CB1125
R39	Res, 8.2K, 5%, 1/4W Comp	1066-8225	Allen-Bradley	CB8225
R40	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R41	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R42	Res, 33.2K, 1%, 1/10W MF	1075-0098	Dale	MFF 1/10
R43	Res, 1.5K, 5%, 1/4W Comp	1066-1525	Allen-Bradley	CB1525
R44	Res, FSV, 5%, 1/4W Comp	1066-XXXX	Allen-Bradley	CBXXXX
R45	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R46	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R47	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R48	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R49	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R50	Res, 1.5K, 5%, 1/4W Comp	1066-1525	Allen-Bradley	CB1525
R51	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R52	Res, 3K, 5%, 1/4W Comp	1066-3025	Allen-Bradley	CB3025
R53	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R54	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R55	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R56	Res, 68K, 5%, 1/4W Comp	1066-6835	Allen-Bradley	CB6835
R57	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R58	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R59	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R60	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R61	Res, 270K, 5%, 1/4W Comp	1066-2745	Allen-Bradley	CB2745
R62	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R63	Res, 3K, 5%, 1/4W Comp	1066-3025	Allen-Bradley	CB3025
R64	Res, 82 Ohm, 5%, 1/2W Comp	1067-8205	Allen-Bradley	EB8205
R65	Res, 82 Ohm, 5%, 1/2W Comp	1067-8205	Allen-Bradley	EB8205

Audio Amplifier and Varactor Control, 4800 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R66	Res, 10 Ohm, 5%, 1/4W Comp	1066-1005	Allen-Bradley	CB1005
R67	Res, 10 Ohm, 5%, 1/4W Comp	1066-1005	Allen-Bradley	CB1005
R68	Res, 22 Ohm, 5%, 1/4W Comp	1066-2205	Allen-Bradley	CB2205
R69	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB2205
	INTEGRATED CIRCUITS			
U1	IC, SN7445N, BCD to Dcml. Dcdr Drvr	2025-0046	TI	SN7445N
U2	IC, LM301A Op Amp	2025-0032	National	LM301A
U3	IC, N5558V, Dual Op Amp	2025-0058	Signetics	N5558V
U4	IC, SN72741P	2025-0067	TI	SN72741P
U5	IC, N5558V, Dual Op Amp	2025-0058	Signetics	N5558V
U6	IC, N5558V, Dual Op Amp	2025-0058	Signetics	N5558V



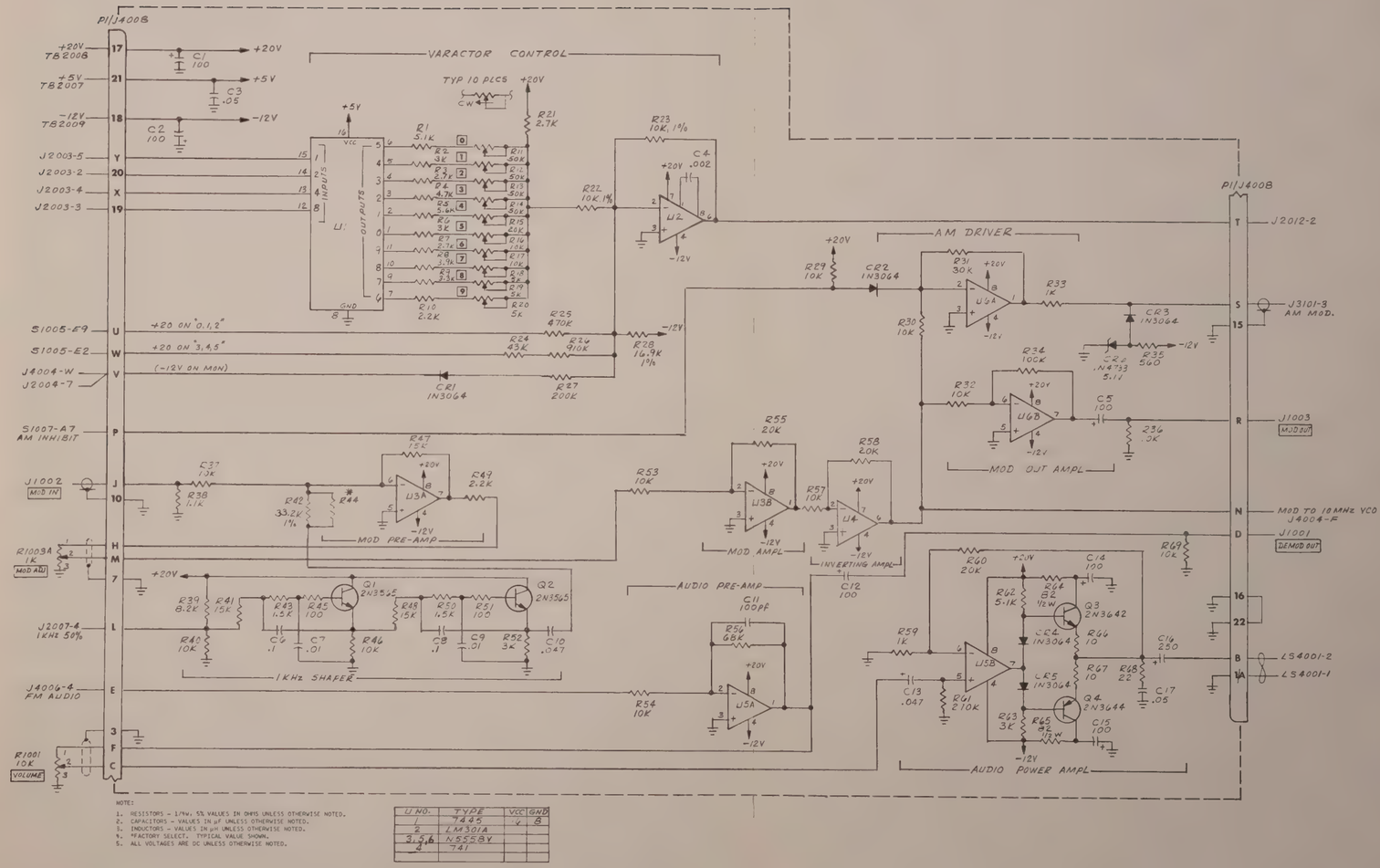


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Figure 6-23. Audio Amplifier and Varactor Control, 4800

Rear Panel Assembly & AC Filter Assembly, 5000, 5200

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
5000	Panel Assy, Rear	7003-0113	Cushman	
	FUSES			
F1	FU, 1 1/2 Amp/125V, 3AG, Slo-Blo	1955-0018	Bussman	MDL 1 1 1/2
F2	FU, 2/10 Amp/250V, 3AG, Slo-Blo	1955-0009	Bussman	MDL 2/10
	TRANSFORMER			
T1	Xfmr, Power	1575-0019	Cushman	
	TRANSISTORS			
Q1	Xstr, 2N3055, NPN Si	1272-0041	RCA	2N3055
Q2	Xstr, 2N3055, NPN Si	1272-0041	RCA	2N3055
Q3	Xstr, 2N3055, NPN Si	1272-0041	RCA	2N3055
5200	PCB Assy - Filter AC	7001-0415	Cushman	
	PC Board	1780-0523	Cushman	
	CAPACITORS			
C1	Cap, 2200pF, 20%, 3K, Disc	1005-0098	Sprague	30GA-D22
C2	Cap, 2200pF, 20%, 3K, Disc	1005-0098	Sprague	30GA-D22
	INDUCTORS			
L1	Choke, 100μH, 20%, 2 Amp	1585-0040	Cushman	
L2	Choke, 100μH, 20%, 2 Amp	1585-0040	Cushman	

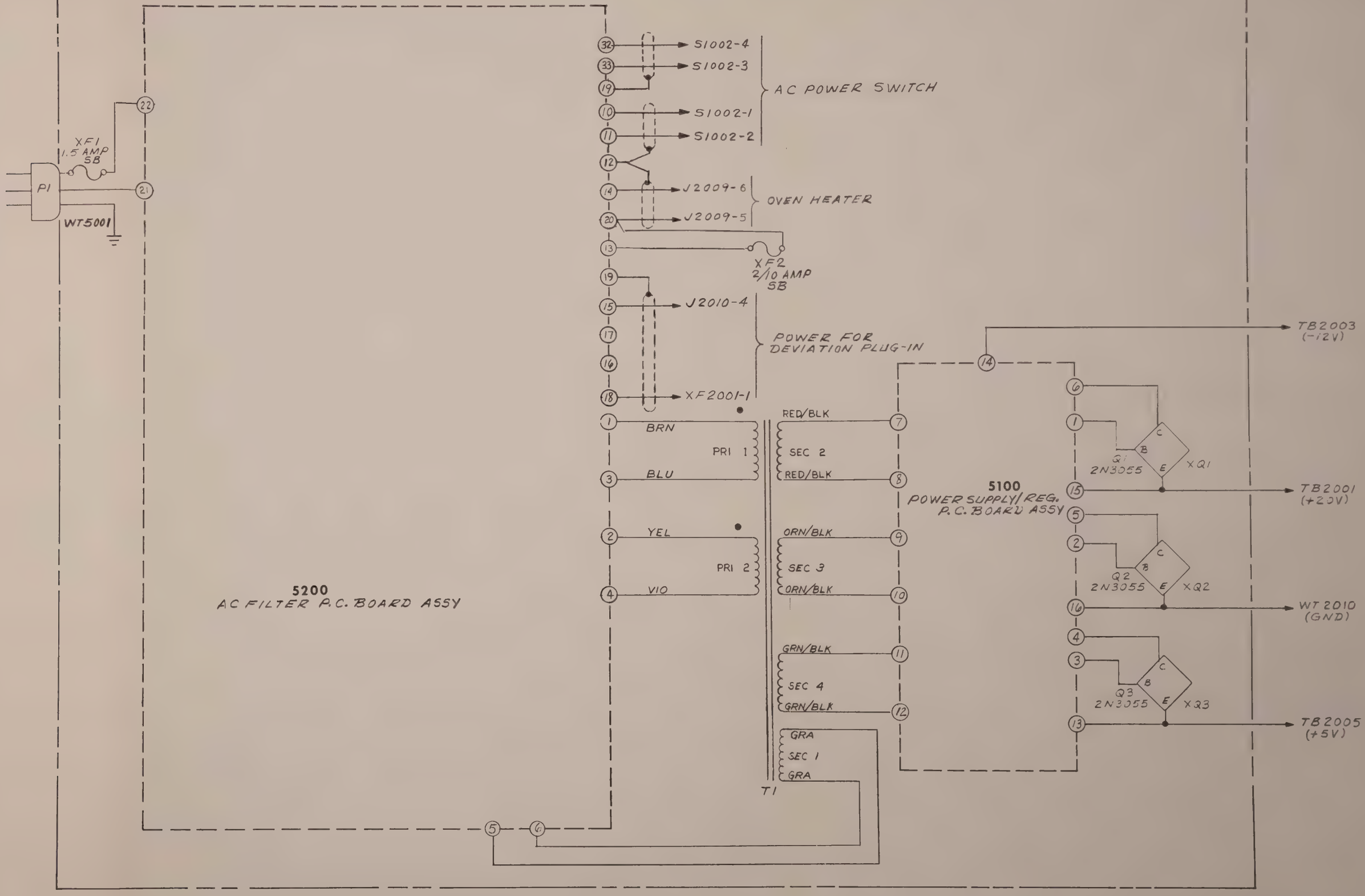


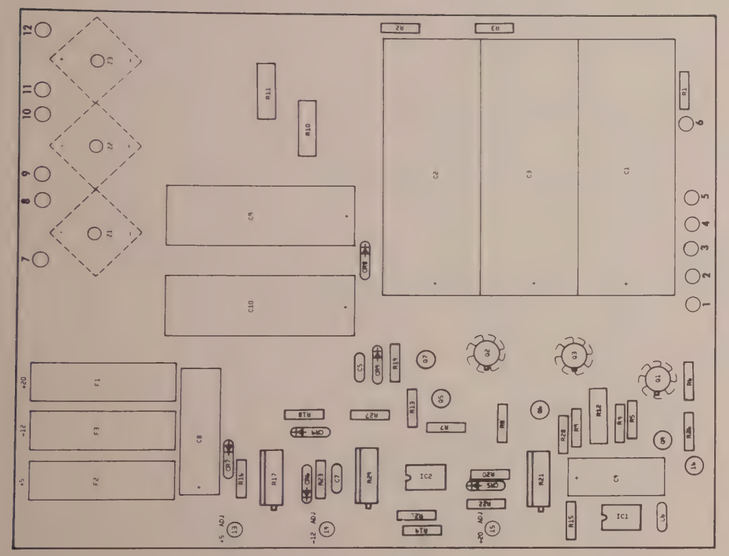
Figure 6-24. Rear Panel Interconnection Diagram, 5000

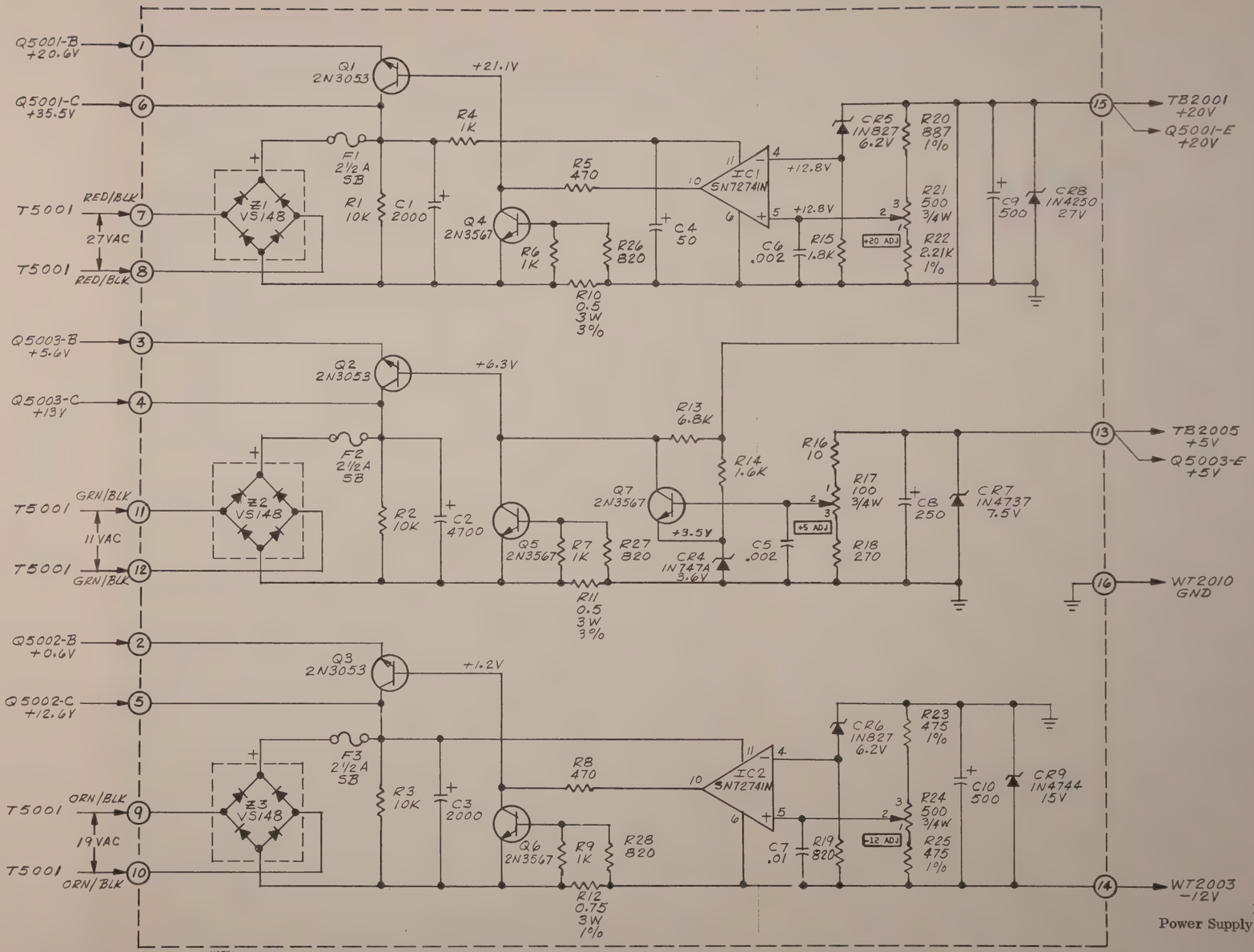
Power Supply/Regulator, 5100

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
5100	Assy, PCB Power Supply/Regulator	7001-0168	Cushman	
	PC Board	1780-0288	Cushman	
	CAPACITORS			
C1	Cap, 2000μF, +150-10%, 50V	1014-0015	Ill. Elna	50T2000
C2	Cap, 4700μF, +150-10%, 25V	1014-0017	Ill. Elna	25T4700
C3	Cap, 2000μF, +150-10%, 50V	1014-0015	Ill. Elna	50T2000
C4	Cap, 50μF, 50V	1013-0007	Ill. Elna	50T50
C5	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C6	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C7	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C8	Cap, 250μF, +75-10%, 16V	1013-0016	Sprague	30D257G016DF2
C9	Cap, 500μF, +100-10%, 25V	1014-0002	Ill. Elna	25T500
C10	Cap, 500μF, +100-10%, 25V	1014-0002	Ill. Elna	25T500
	DIODES			
CR1	Not Used			
CR2	Not Used			
CR3	Not Used			
CR4	Diode, 1N747A Zener	1281-0076	Motorola	1N747A
CR5	Diode, 1N827	1281-0038	Transitron	1N827
CR6	Diode, 1N827	1281-0038	Transitron	1N827
CR7	Diode, 1N4737	1281-0026	IR	1N4737
CR8	Diode, 1N4750	1281-0052	Motorola	1N4750
CR9	Diode, 1N4744	1281-0028	Motorola	1N4744
	FUSES			
F1	Fuse, 2 1/2 Amp, Slo Blo	1955-0023	Bussman	MDL 2-1/2 S/B
F2	Fuse, 2 1/2 Amp, Slo Blo	1955-0023	Bussman	MDL 2-1/2 S/B
F3	Fuse, 2 1/2 Amp, Slo Blo	1955-0023	Bussman	MDL 2-1/2 S/B
	TRANSISTORS			
Q1	Trans, 2N3053	1272-0011	RCA	2N3053
Q2	Trans, 2N3053	1272-0011	RCA	2N3053
Q3	Trans, 2N3053	1272-0011	RCA	2N3053
Q4	Trans, 2N3567	1272-0014	Fairchild	2N3567
Q5	Trans, 2N3567	1272-0014	Fairchild	2N3567
Q6	Trans, 2N3567	1272-0014	Fairchild	2N3567
Q7	Trans, 2N3567	1272-0014	Fairchild	2N3567
	RESISTORS			
R1	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R2	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R3	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R4	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R5	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R6	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R7	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R8	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R9	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R10	Res, .5 Ohm, 3%, 3W WW	1159-0002	Dale	RS-2B

Power Supply/Regulator, 5100 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R11	Res, .5 Ohm, 3%, 3W WW	1159-0002	Dale	RS-2B
R12	Res, .75 Ohm, 1%, 3W WW	1159-0005	Dale	RS-2B
R13	Res, 6.8K, 5%, 1/4W Comp	1066-6825	Allen-Bradley	CB6825
R14	Res, 1.6K, 5%, 1/4W Comp	1066-1625	Allen-Bradley	CB1625
R15	Res, 1.8K, 5%, 1/4W Comp	1066-1825	Allen-Bradley	CB1825
R16	Res, 10 Ohm, 5%, 1/4W Comp	1066-1005	Allen-Bradley	CB1005
R17	Pot, 100 Ohm, 10%, 3/4W	1215-0010	Helitrim	89WR
R18	Res, 270 Ohm, 5%, 1/4W Comp	1066-2715	Allen-Bradley	CB2715
R19	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R20	Res, 887 Ohm, 1%, 1/8W MF	1075-0022	Dale	MFF 1/8
R21	Pot, 500 Ohm, 10%, 3/4W	1215-0011	Helitrim	89WR
R22	Res, 2.21K, 1%, 1/8W MF	1075-0010	Dale	MFF 1/8
R23	Res, 475 Ohm, PPM Metal Film	1075-0023	Dale	MFF 1/8
R24	Pot, 500 Ohm, 10%, 3/4W	1215-0011	Helitrim	89WR
R25	Res, 475 Ohm, PPM Metal Film	1075-0023	Dale	MFF 1/8
R26	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R27	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
R28	Res, 820 Ohm, 5%, 1/4W Comp	1066-8215	Allen-Bradley	CB8215
	INTEGRATED CIRCUITS			
U1	IC, SN72741P	2025-0067	TI	SN72741P
U2	IC, SN72741P	2025-0067	TI	SN72741P
	BRIDGE RECTIFIERS			
Z1	Dio, VS148 Si Brdg Rect 100 PIV 2A	1281-5003	Varo	VS148
Z2	Dio, VS148 Si Brdg Rect 100 PIV 2A	1281-5003	Varo	VS148
Z3	Dio, VS148 Si Brdg Rect 100 PIV 2A	1281-5003	Varo	VS148





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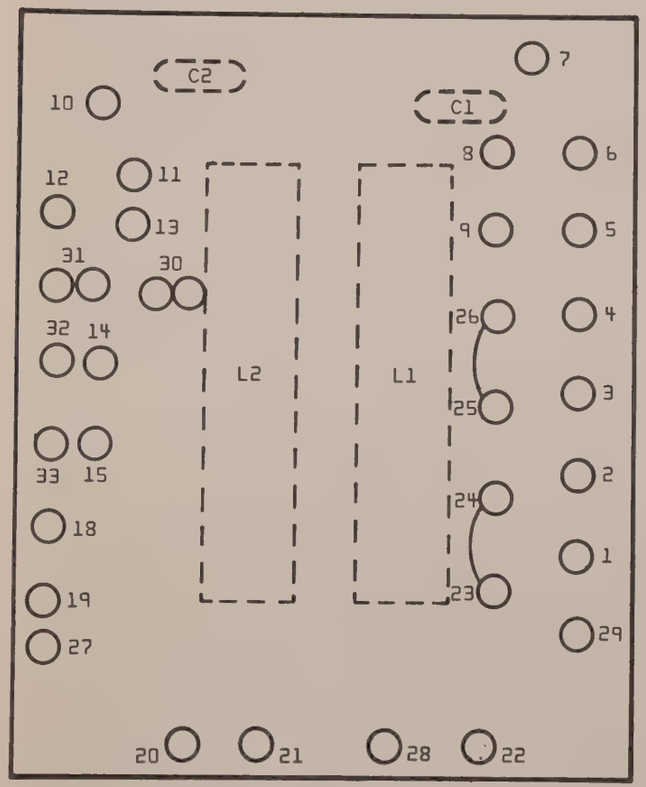
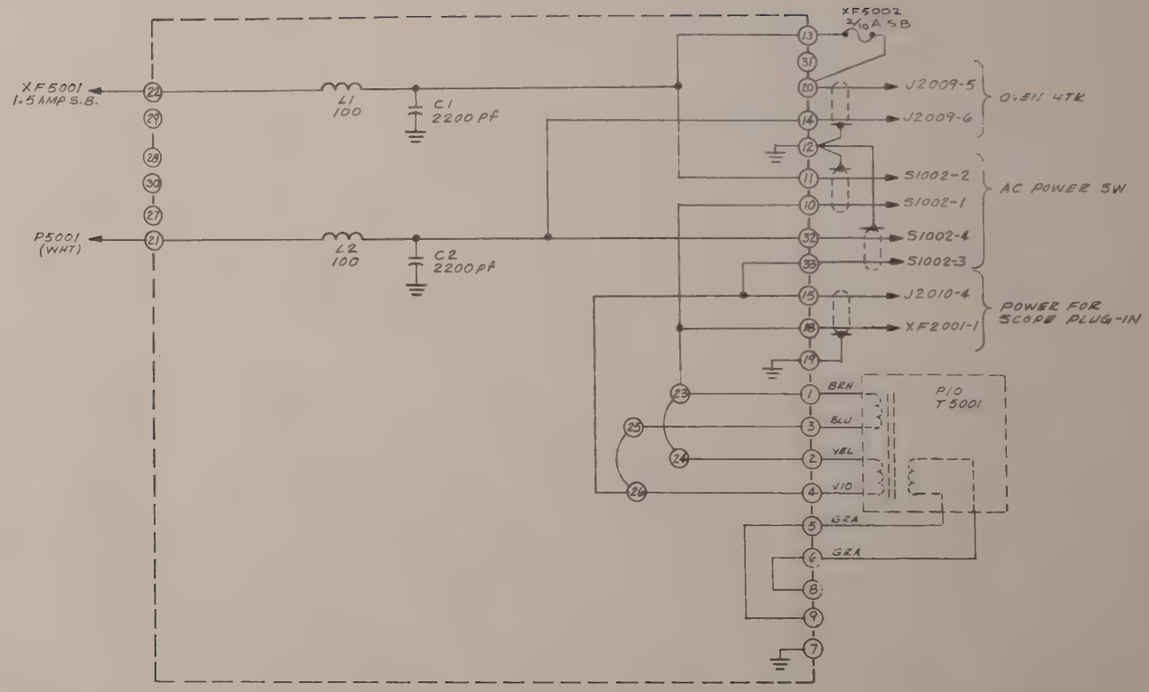
NOTE:
1. RESISTORS – 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS – VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS – VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

Figure 6-25.
Power Supply/Regulator, 5100





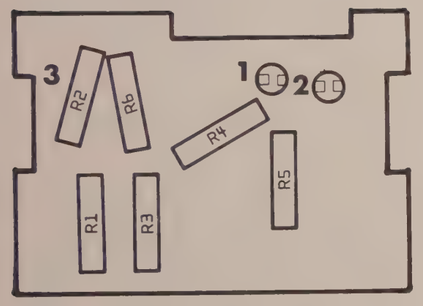
NOTE:

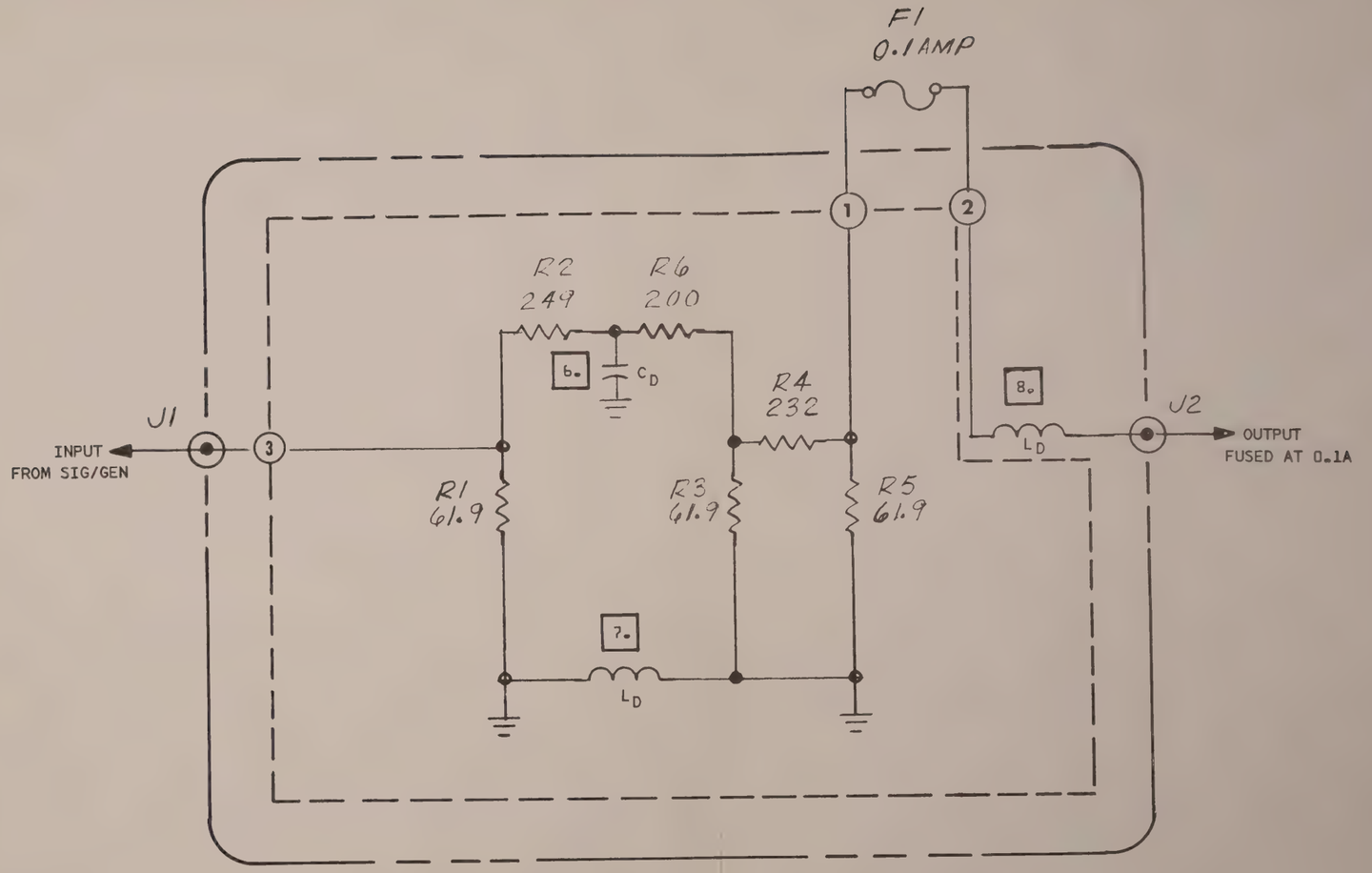
1. RESISTORS – 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS – VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS – VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.
6. INSTALL MODIFICATION KIT 7100-0083 FOR 230 VAC OPERATION.

Figure 6-26. A. C. Filter, 5200

40 dB Attenuator

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	Pad Assy, 40 dB	7001-0430	Cushman	
	PC Board	1780-0737	Cushman	
	FUSE			
F1	FU, 1/10 Amp/125V Mintr Fast-Bl	1955-0032	Littelfuse	273.100
	CONNECTOR			
J1	Assy, Connector BNC Type Modified	2536-0050	Cushman	
	RESISTORS			
R1	Res, 61.9 Ohm, 1%, 1/10W MF	1075-0007	Dale	MFF 1/10
R2	Res, 249 Ohm, 1%, 1/10W MF	1074-0098	Dale	MFF 1/10
R3	Res, 61.9 Ohm, 1%, 1/10W MF	1075-0007	Dale	MFF 1/10
R4	Res, 232 Ohm, 1%, 1/10W MF	1074-0097	Dale	MFF 1/10
R5	Res, 61.9 Ohm, 1%, 1/10W MF	1075-0007	Dale	MFF 1/10
R6	Res, 200 Ohm, 1%, 1/8W MF	1075-0082	Dale	MFF 1/8





NOTE:

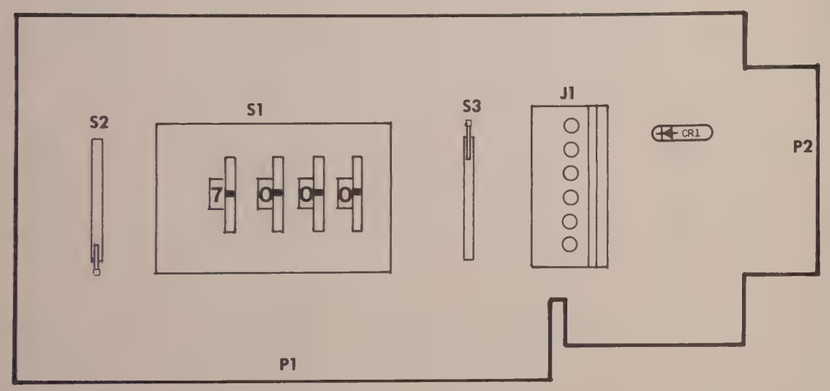
1. RESISTORS - 1% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

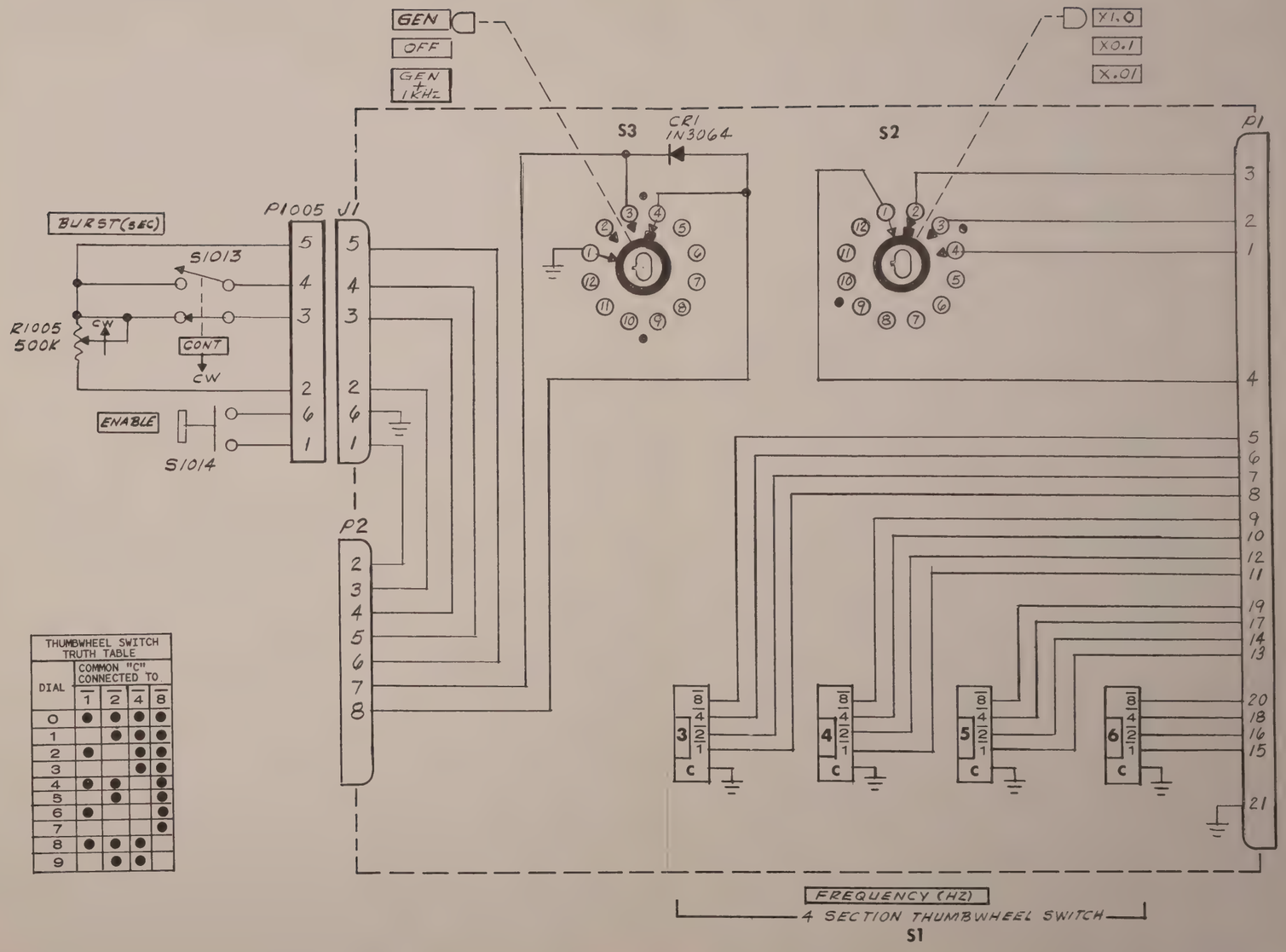
6. STRIPLINE CAPACITOR SEGMENTS

7. GROUND PLANE SLOT-SHORT AS REQUIRED.

8. LEAD LENGTH OF COAX ADJUSTED FOR FLATNESS.

Figure 6-27. 40 dB Attenuator





THUMBWHEEL SWITCH TRUTH TABLE

DIAL	COMMON "C" CONNECTED TO 1	2	4	8
0	●	●	●	●
1		●	●	●
2	●		●	●
3			●	●
4	●	●		●
5		●		●
6	●			●
7				●
8	●	●	●	
9		●	●	

Figure 6-28. Switch Mounting, M10

Audio Amplifier and Varactor Control M10, 4800-M10

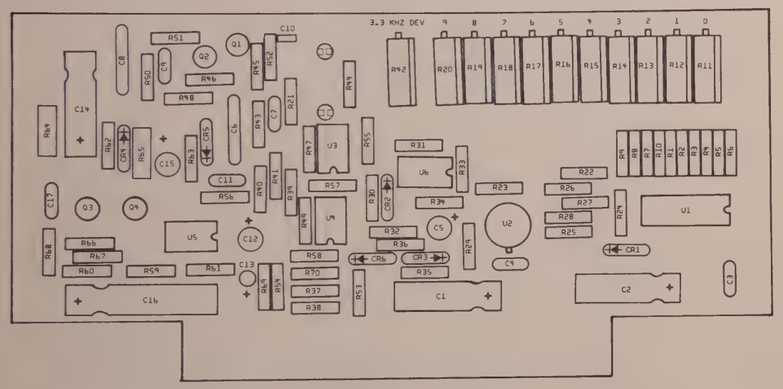
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
4800M10	PCB Assy, Audio Ampl & Varactor	7001-0416	Cushman	
	PC Board	1780-0711	Cushman	
	CAPACITORS			
C1	Cap, 100μF, 10%, 25V	1013-0003	Sprague	30D107G025DD5
C2	Cap, 100μF, 10%, 25V	1013-0003	Sprague	30D107G025DD5
C3	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C4	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C5	Cap, 100μF, 20%, 20V	1011-0010	Kemet	T362D107M020AS
C6	Cap, .1μF, 10%, 100V	1008-0031	Sprague	225P10491
C7	Cap, .01μF, 10%, 200V	1005-0065	Aerovox	CK06BX103K
C8	Cap, .1μF, 10%, 100V	1008-0031	Sprague	225P10491
C9	Cap, .01μF, 10%, 200V	1005-0065	Aerovox	CK06BX103K
C10	Cap, .047μF, 20%, 100V Mini	1005-0096	Erie	8121-100-651-473M
C11	Cap, 100PF, 5%, 500V Mica	1002-0011	Elmenco	DM15-F-101J
C12	Cap, 100μF, 20%, 20V	1011-0010	Kemet	T362D107M020AS
C13	Cap, 2.2μF, 10%, 35V	1011-0001	Dickson	D2RdGSB35K
C14	Cap, 100μF, 20%, 20V	1011-0010	Kemet	T363D107M020AS
C15	Cap, 100μF, 20%, 20V	1011-0010	Kemet	T363D107M020AS
C16	Cap, 250μF, +75-10%, 16V	1013-0016	Sprague	30D257G016DF2
C17	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
	DIODES			
CR1	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR2	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR3	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR4	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR5	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR6	Diode, 1N4733	1281-0015	Motorola	1N4733
	TRANSISTORS			
Q1	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q2	Trans, 2N3565	1272-0017	Fairchild	2N3565
Q3	Trans, 2N3642	1272-0018	Fairchild	2N3642
Q4	Trans, 2N3644	1272-0040	Fairchild	2N3644
	RESISTORS			
R1	Res,5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R2	Res, 3 K, 5%, 1/4W Comp	1066-3025	Allen-Bradley	CB3025
R3	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R4	Res, 4.7K, 5%, 1/4W Comp	1066-4725	Allen-Bradley	CB4725
R5	Res, 5.6K, 5%, 1/4W Comp	1066-5625	Allen-Bradley	CB5625
R6	Res, 3K, 5%, 1/4W Comp	1066-3025	Allen-Bradley	CB3025
R7	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R8	Res, 3.9K, 5%, 1/4W Comp	1066-3925	Allen-Bradley	CB3925
R9	Res, 3.3K, 5%, 1/4W Comp	1066-3325	Allen-Bradley	CB3325
R10	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R11	Pot,100K, 10%, 3/4W	1215-0006	Helitrim	89WR
R12	Pot,100K, 10%, 3/4W	1215-0006	Helitrim	89WR
R13	Pot, 50K, 10%, 3/4W	1215-0023	Beckman	89WR
R14	Pot, 50K, 10%, 3/4W	1215-0023	Beckman	89WR
R15	Pot, 20K, 10%, 3/4W	1215-0021	Beckman	89WR

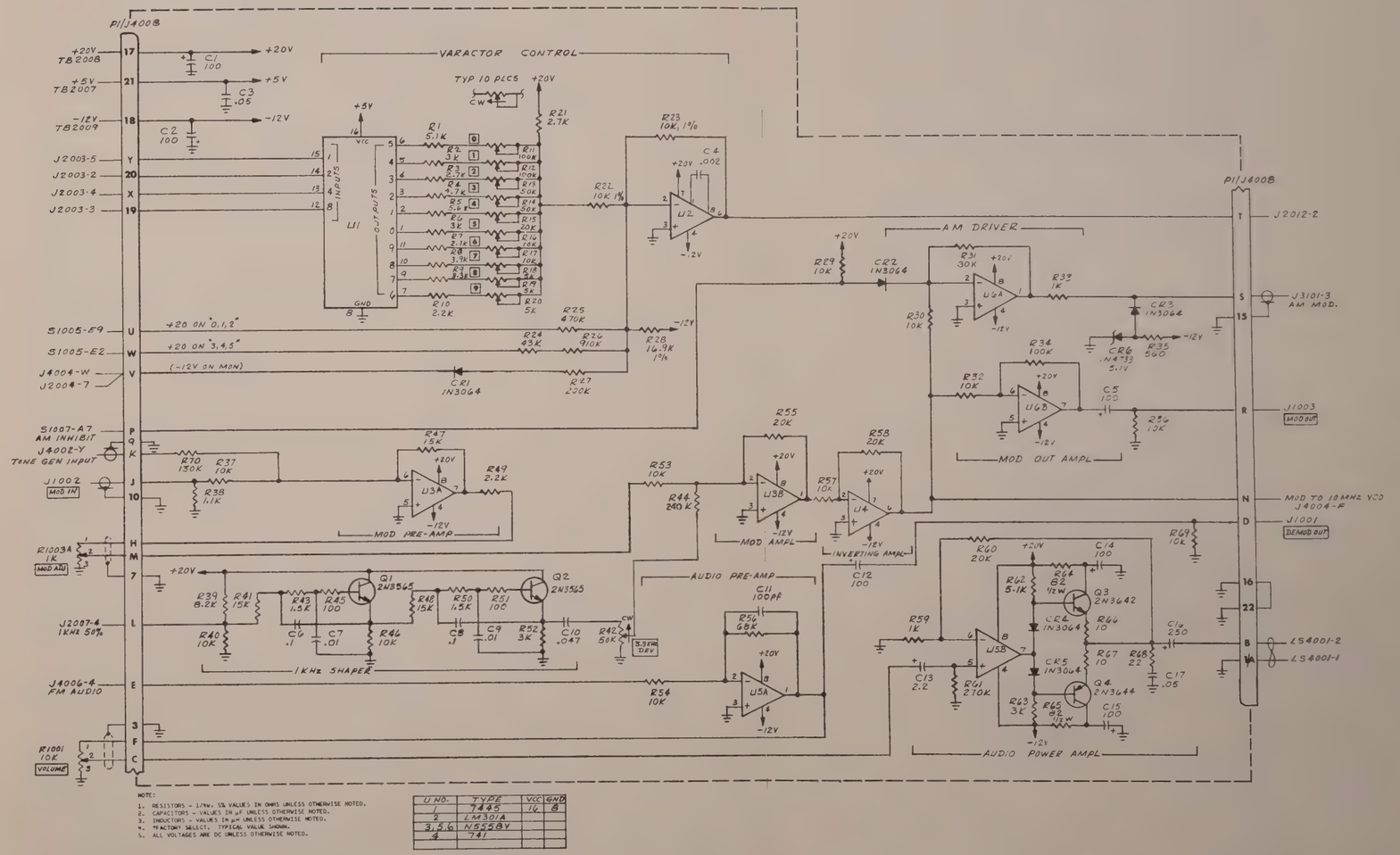
Audio Amplifier and Varactor Control M10, 4800-M10 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R16	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R17	Pot, 10K, 10%, 3/4W	1215-0014	Helitrim	89WR
R18	Pot, 5K, 10%, 3/4W	1215-0012	Helitrim	89WR
R19	Pot, 5K, 10%, 3/4W	1215-0012	Helitrim	89WR
R20	Pot, 5K, 10%, 3/4W	1215-0012	Helitrim	89WR
R21	Res, 2.7K, 5%, 1/4W Comp	1066-2725	Allen-Bradley	CB2725
R22	Res, 10K, 1%, 1/8W MF	1075-0009	Dale	MF 1/8
R23	Res, 10K, 1%, 1/8W MF	1075-0009	Dale	MF 1/8
R24	Res, 43K, 5%, 1/4W Carbon Comp	1066-4335	Allen-Bradley	CB4335
R25	Res, 470K, 5%, 1/4W Comp	1066-4745	Allen-Bradley	CB4745
R26	Res, 910K, 5%, 1/4W Carbon Comp	1066-9145	Allen-Bradley	CB9145
R27	Res, 200K, 5%, 1/4W Comp	1066-2045	Allen-Bradley	CB2045
R28	Res, 16.9K, 1%, 1/8W	1075-0059	Dale	MF 1/8
R29	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R30	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R31	Res, 30K, 5%, 1/4W Carbon Comp	1066-3035	Allen-Bradley	CB3035
R32	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R33	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R34	Res, 100K, 5%, 1/4W Comp	1066-1045	Allen-Bradley	CB1045
R35	Res, 560 Ohm, 5%, 1/4W C omp	1066-5615	Allen-Bradley	CB5615
R36	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R37	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R38	Res, 1.1K, 5%, 1/4W Comp	1066-1125	Allen-Bradley	CB1125
R39	Res, 8.2K, 5%, 1/4W Comp	1066-8225	Allen-Bradley	CB8225
R40	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R41	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen0Bradley	CB1535
R42	Pot, 50K, 10%, 3/4W	1215-0023	Beckman	89WR
R43	Res, 1.5K, 5%, 1/4W Comp	1066-1525	Allen-Bradley	CB1525
R44	Res, 240K, 5%, 1/4W Comp	1066-2445	Allen-Bradley	CB2445
R45	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R46	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R47	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R48	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R49	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R50	Res, 1.5K, 5%, 1/4W Comp	1066-1525	Allen-Bradley	CB1525
R51	Res, 100 Ohm, 5%, 1/4W Comp	1066-1015	Allen-Bradley	CB1015
R52	Res, 3K, 5%, 1/4W Comp	1066-3025	Allen-Bradley	CB3025
R53	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R54	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R55	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R56	Res, 68K, 5%, 1/4W Comp	1066-6835	Allen-Bradley	CB6835
R57	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R58	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R59	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R60	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R61	Res, 270K, 5%, 1/4W Comp	1066-2745	Allen-Bradley	CB2745
R62	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R63	Res, 3K, 5%, 1/4W Comp	1066-3025	Allen-Bradley	CB3025
R64	Res, 82 Ohm, 5%, 1/4W Comp	1066-8205	Allen-Bradley	CB8205
R65	Res, 82 Ohm, 5%, 1/4W Comp	1066-8205	Allen-Bradley	CB8205

Audio Amplifier and Varactor Control M10, 4800-M10 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R66	Res, 10 Ohm, 5%, 1/4W Comp	1066-1005	Allen-Bradley	CB1005
R67	Res, 10 Ohm, 5%, 1/4W Comp	1066-1005	Allen-Bradley	CB1005
R68	Res, 22 Ohm, 5%, 1/4W Comp	1066-2205	Allen-Bradley	CB2205
R69	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R70	Res, 130K, 5%, 1/4W Comp	1066-1345	Allen-Bradley	CB1345
	INTEGRATED CIRCUITS			
U1	IC, SN7445N, BCD to Dcml Dcdr Dvr	2025-0046	TI	SN7445N
U2	IC, LM301A Op Amp	2025-0032	National	LM301A
U3	IC, N5558V, Dual Op Amp	2025-0058	Signetics	N5558V
U4	IC, SN72741P	2025-0067	TI	SN72741P
U5	IC, N5558V, Dual Op Amp	2025-0058	Signetics	N5558V
U6	IC, N5558V, Dual Op Amp	2025-0058	Signetics	N5558V





NOTE:
1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

U NO.	TYPE	VCC	GND
1	7445	16	8
2	LM301A		
3,5,6	N555BV		
4	741		

Figure 6-29. Audio Amplifier and Varactor Control, 4800-M10

5601**0065**2

Frequency Synthesizer and Switch Mounting M10, 4900/1100-M10

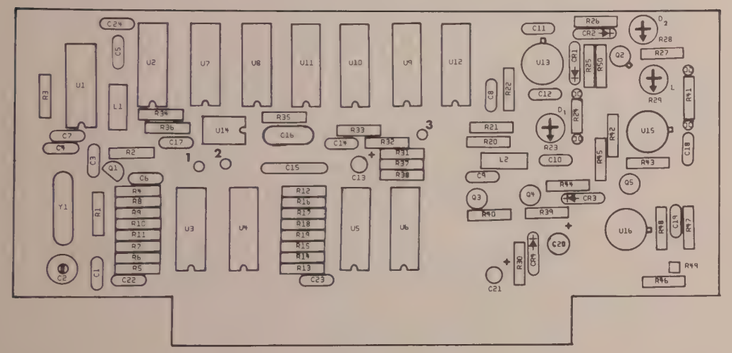
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
4900	PCB Assy, Frequency Synthesizer	7001-0383	Cushman	
	PC Board	1780-0714	Cushman	
	CAPACITORS			
C1	Cap, 30PF, 5%, 500V Mica	1002-0043	Elmenco	DM15-E-300J
C2	Cap, 9-35PF, 200V Vert Trim	1001-0006	Erie	538-002-94D
C3	Cap, 100PF, 2%, 500V Mica	1002-0050	Elmenco	DM15-F-101G
C4	Cap, 390PF, 5%, 500V Mica	1002-0033	Elmenco	DM15-F-391J
C5	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C6	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C7	Cap, .002μF, 20%, 500V Disc	1005-0003	Erie	831-596-Z5U-202M
C8	Cap, 39PF, 5%, 500V Mica	1002-0018	Elmenco	DM15-E-390J
C9	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C10	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C11	Cap, 30PF, 5%, 500V Mica	1002-0043	Elmenco	DM15-E-300J
C12	Cap, 200PF, 5%, 500V Mica	1002-0042	Elmenco	DM15-F-201J
C13	Cap, 1μF, 20%, 50V	1011-0013	ITT	TAG-F-20-1/50-20
C14	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C15	Cap, 1.5μF, 10%, 35V	1013-0001	Sprague	150D155X9035B2
C16	Cap, .22MF, 10%, 100V Mylar	1008-0091	Electrocube	232A1B224K
C17	Cap, .01μF, +80-20%, 25V Disc	1005-0013	Erie	5835-512-Y5U-103Z
C18	Cap, 30PF, 5%, 500V Mica	1002-0043	Elmenco	DM15-E-300J
C19	Cap, 150PF, 5%, 500V Mica	1002-0021	Elmenco	DM15-F-151J
C20	Cap, 47μF, 20%, 20V	1011-0009	Dickson	D47GSC20M
C21	Cap, 1μF, 20%, 50V	1011-0013	ITT	TAG-F-20-1/50-20
C22	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C23	Cap, .05μF, +80-20%, 25V Disc	1005-0014	Erie	5855-505-Y5U0-503Z
C24	Cap, 390 pF, 5%, 500V Min Cer	1002-0033	Elmenco	DM15-F-391J
	DIODES			
CR1	Diode, HPA2800	1283-0001	HPA	5082-2800
CR2	Diode, HPA2800	1283-0001	HPA	5082-2800
CR3	Diode, 1N3064	1281-0013	Teledyne	1N3064
CR4	Diode, 1N4744	1281-0028	Motorola	1N4744
CR1101	Diode, 1N3064	1281-0013	Teledyne	1N3064
	CONNECTORS			
J1101	Conn, 22 Cntct. Rtang PCB Edge HSG	2535-0098	Molex	09-02-2222
J1102	Conn, Rtang 9 Contact	2535-0100	Cushman	
J1103	Conn, 6 Pin Locking Mintr JK	2535-0074	Cablewave	700169-002
J4002	Conn, PC Board 44 Pin Dbl Row	2535-0023	Viking	2VK22D/1-1
	INDUCTORS			
L1	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
L2	Choke, 100μH, 5%	1585-0017	Delevan	1537-76
	TRANSISTORS			
Q1	Trans, 2N3904	1272-0032	Motorola	2N3904
Q2	XSTR, 2N4119	1272-0078	National	2N4119
Q3	Trans, 2N4275	1272-0016	Fairchild	2N4275
Q4	Trans, 2N4249	1272-0024	Fairchild	2N4249
Q5	Trans, 2N4391	1272-0042	Teledyne	2N4391

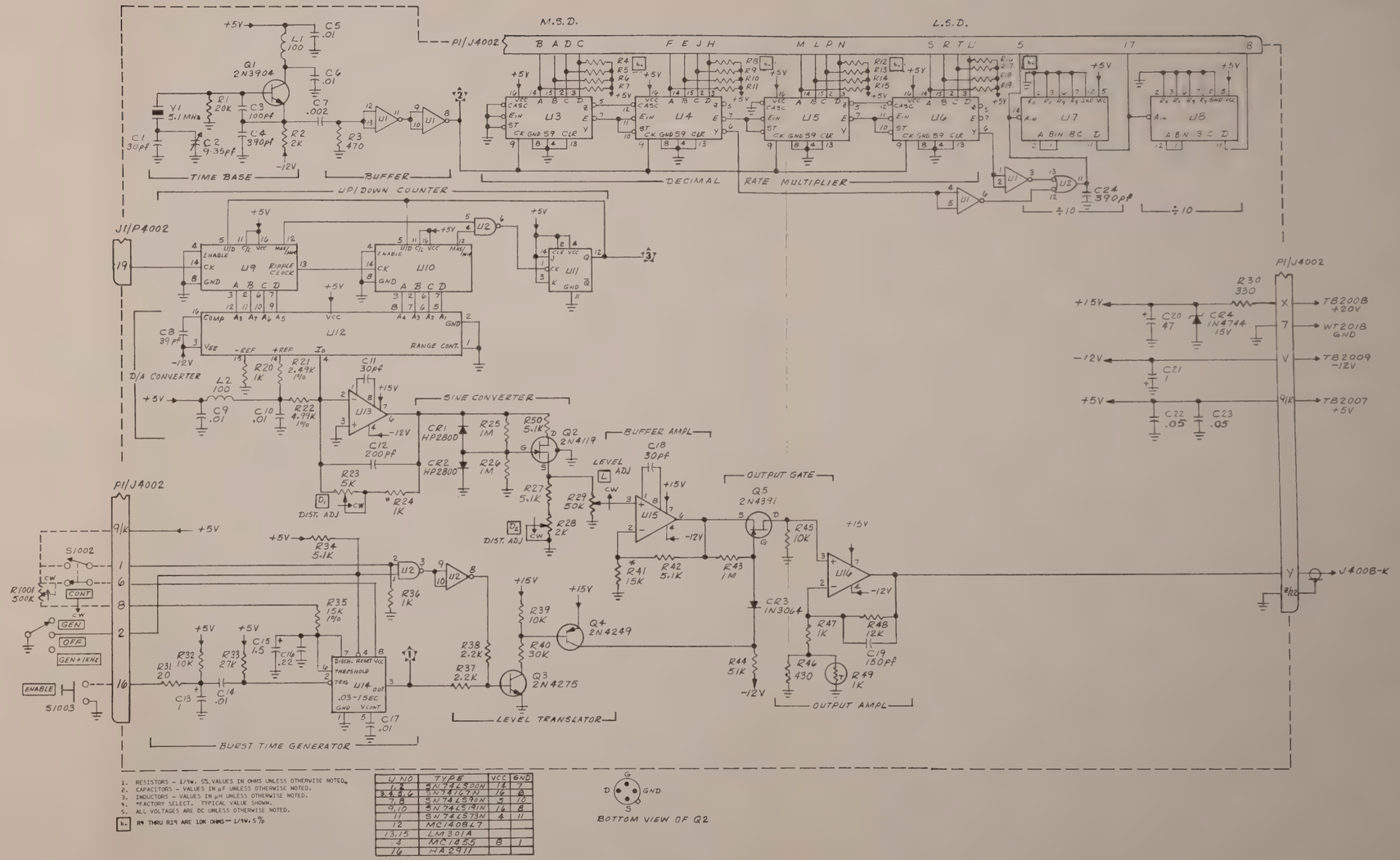
Frequency Synthesizer and Switch Mounting M10, 4900/1100-M10 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	RESISTORS			
R1	Res, 20K, 5%, 1/4W Comp	1066-2035	Allen-Bradley	CB2035
R2	Res, 2K, 5%, 1/4W Comp	1066-2025	Allen-Bradley	CB2025
R3	Res, 470 Ohm, 5%, 1/4W Comp	1066-4715	Allen-Bradley	CB4715
R4	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R5	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R6	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R7	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R8	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R9	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R10	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R11	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R12	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R13	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R14	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R15	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R16	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R17	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R18	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R19	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R20	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R21	Res, 2.49K, 1%, 1/8W MF	1075-0027	Dale	MF 1/8
R22	Res, 4.99K, 1%, 1/8W MF	1075-0095	Dale	MF 1/8
R23	Pot, 5K, 20%, 1/2W 1 Trn Cer Trim	1203-0071	Beckman	91AR5K
R24	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R25	Res, 1 Meg 5%, 1/4W Comp	1066-1055	Allen-Bradley	CB1055
R26	Res, 1 Meg 5%, 1/4W Comp	1066-1055	Allen-Bradley	CB1055
R27	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R28	Pot, 2K, 20%, 1/2W 1 Trn Cer Trim	1203-0072	Beckman	91AR2K
R29	Pot, 50K, 20%, 1/2W 1 Trn Cer Trim	1203-0070	Beckman	91AR50K
R30	Res, 300 Ohm, 5%, 1/4W Comp	1066-3315	Allen-Bradley	CB3315
R31	Res, 20 Ohm, 5%, 1/4W Comp	1066-2005	Allen-Bradley	CB2005
R32	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R33	Res, 27K, 5%, 1/4W Comp	1066-2735	Allen-Bradley	CB2735
R34	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R35	Res, 15K, 1%, 1/8W MF	1075-0081	Dale	MF 1/8
R36	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R37	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R38	Res, 2.2K, 5%, 1/4W Comp	1066-2225	Allen-Bradley	CB2225
R39	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R40	Res, 30K, 5%, 1/4W Comp	1066-3035	Allen-Bradley	CB3035
R41	Res, 15K, 5%, 1/4W Comp	1066-1535	Allen-Bradley	CB1535
R42	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125
R43	Res, 1 Meg, 5%, 1/4W Comp	1066-1055	Allen-Bradley	CB1055
R44	Res, 51K, 5%, 1/4W Comp	1066-5135	Allen-Bradley	CB5135
R45	Res, 10K, 5%, 1/4W Comp	1066-1035	Allen-Bradley	CB1035
R46	Res, 430 Ohm, 5%, 1/4W Comp	1066-4315	Allen-Bradley	CB4315
R47	Res, 1K, 5%, 1/4W Comp	1066-1025	Allen-Bradley	CB1025
R48	Res, 12K, 5%, 1/4W Comp	1066-1235	Allen-Bradley	CB1235
R49	Thrmis, 1K	1253-0002	Veco	31E2
R50	Res, 5.1K, 5%, 1/4W Comp	1066-5125	Allen-Bradley	CB5125

Frequency Synthesizer and Switch Mounting M10, 4900/1100-M10 (cont)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
	INTEGRATED CIRCUITS			
U1	IC, SN74LS00N, TTL Nand Gates	2025-0114	TI	SN74LS00N
U2	IC, SN74LS00N, TTL Nand Gates	2025-0114	TI	SN74LS00N
U3	IC, SN74167N, Syn Decade Rt. Mltplr.	2025-0097	TI	SN74167N
U4	IC, SN74167N, Syn Decade Rt. Mltplr.	2025-0097	TI	SN74167N
U5	IC, SN74167N, Syn Decade Rt. Mltplr.	2025-0097	TI	SN74167N
U6	IC, SN74167N, Syn Decade Rt. Mltplr.	2025-0097	TI	SN74167N
U7	IC, SN74LS90N, Decade Counter	2025-0113	TI	SN74LS90N
U8	IC, SN74LS90N, Decade Counter	2025-0113	TI	SN74LS90N
U9	IC, SN74LS191N, Syn Up/Dwn Cntrs.	2025-0115	TI	SN74LS191N
U10	IC, SN74LS191N, Syn Up/Dwn Cntrs.	2025-0115	TI	SN74LS191N
U11	IC, SN74LS73N, Dual J-K Flip Flop	2025-0110	TI	SN74LS73N
U12	IC, MC1408L-7 D-to-A Converter	2025-0089	Motorola	MC1408L-7
U13	IC, LM301A, Op Amp	2025-0032	National	LM301A
U14	IC, MC1455P1, Timing Circuit	2025-0091	Motorola	MC1455P1
U15	IC, LM301A, Op Amp	2025-0032	National	LM301A
U16	IC, HA-2911, Wide Band Op Amp	2025-0033	Harris Semi	HA2-911-5
	CRYSTAL			
Y1	Xtal, 5.1 MHz	2035-0022	Cushman	
	SWITCHES			
S1101	Swassy 4 Sect Thumbwheel	7011-0028	Cushman	
S1102	Sw, Lever 1 P 3 Pos PCB Mount	1851-0094	Cushman	
S1103	Sw, Lever 1 P 3 Pos PCB Mount	1851-0094	Cushman	





1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

b. R4 THRU R19 ARE 10K OHMS - 1/4W, 5%

U NO	TYPE	VCC	GND
1,2	SN74LS00N	14	7
3,4,5,6	SN74167N	16	8
7,8	SN74LS90N	5	10
9,10	SN74LS191N	16	8
11	SN74LS73N	4	11
12	MC14081BCL7		
13,15	LM301A		
14	MC1455	8	1
16	HA2911		

Figure 6-30. Frequency Synthesizer, 4900-M10

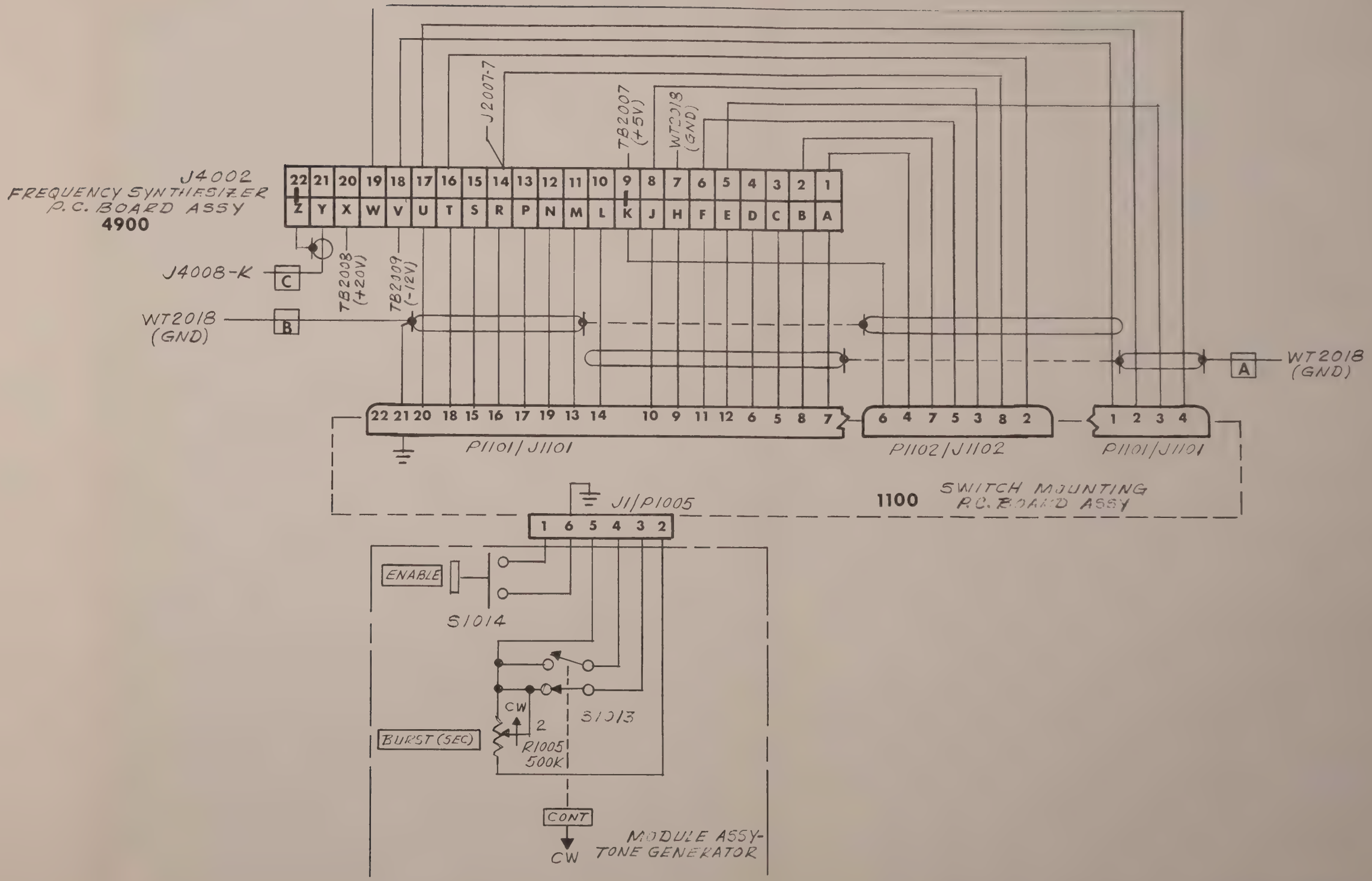
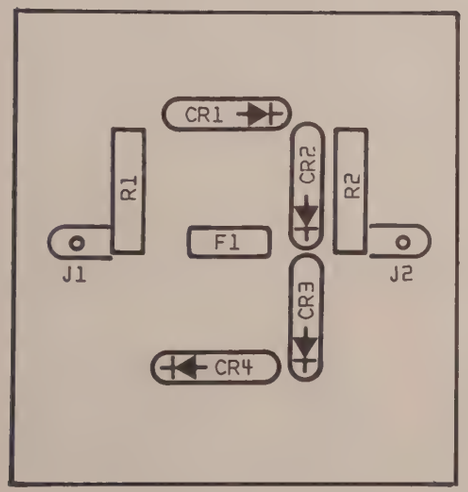
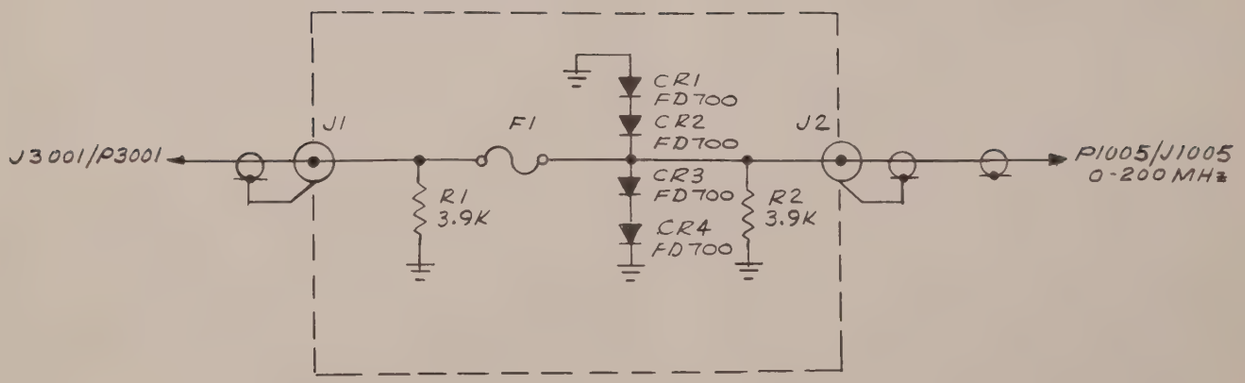


Figure 6-31. Tone Generator Interconnection Diagram, CE-4 M10

WIDE BAND AMPLIFIER FUSE ASSEMBLY. 3050-M11

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3050	Wide Band Ampl			
	PC Board Assy	7001-0455	Cushman	
	PC Board	1780-0263	Cushman	
	CABLE ASSEMBLY			
	3" RG-188 Right Angle Plug to Ferrule	7032-1702	Cushman	
	15" RG-188 BHD to Ferrule	7032-5243	Cushman	
	FUSE			
F1	1/8 Amp AT 125V	1955-0019	Littelfuse	275.125
	DIODES			
CR1	Pico Second Computer	1281-0061	Fairchild	FD700
CR2	Pico Second Computer	1281-0061	Fairchild	FD700
CR3	Pico Second Computer	1281-0061	Fairchild	FD700
CR4	Pico Second Computer	1281-0061	Fairchild	FD700
	RESISTORS			
R1	Comp, 3.9K, ±5%, 1/4W	1066-3925	Allen-Bradley	CB3925
R2	Comp, 3.9K, ±5%, 1/4W	1066-3925	Allen-Bradley	CB3925





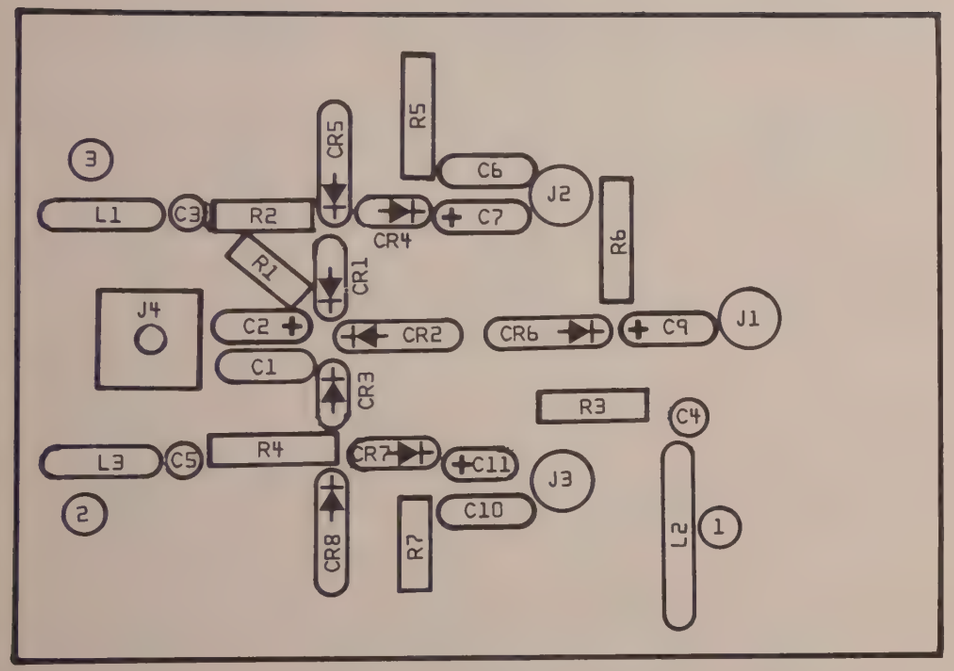
NOTE:

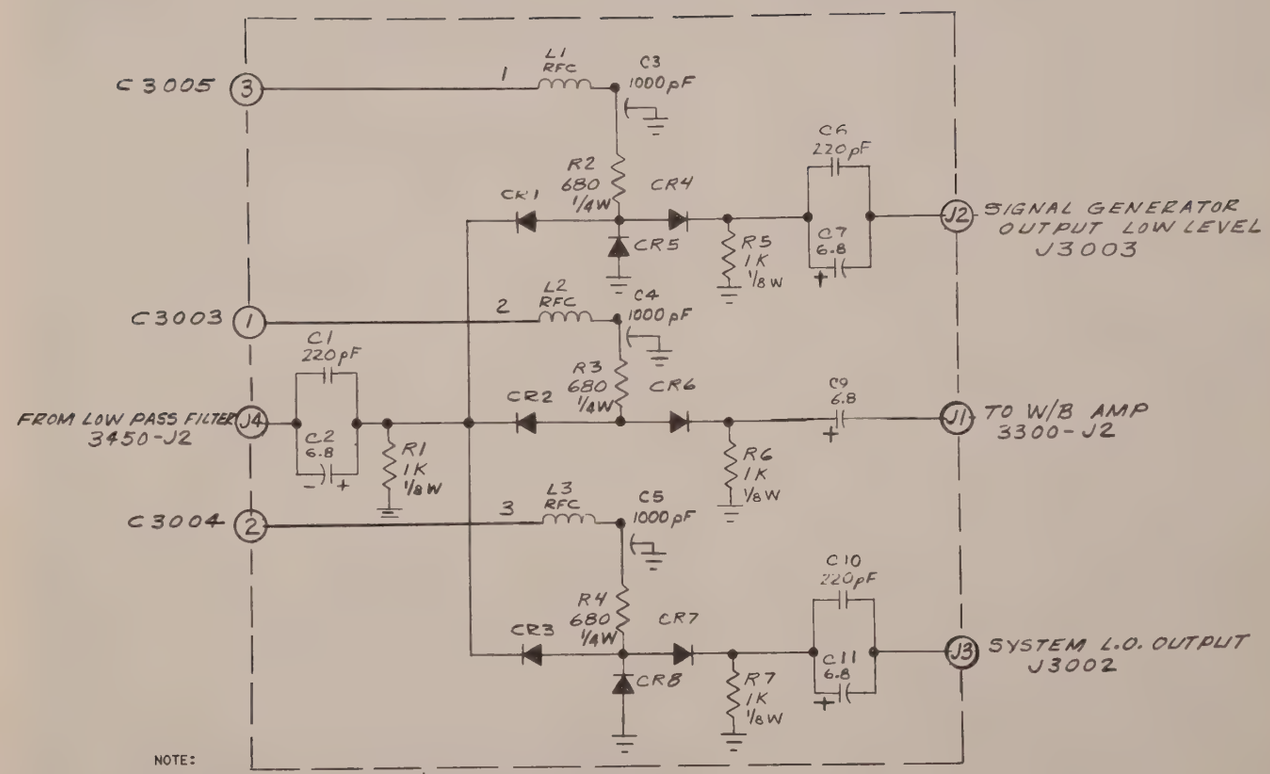
1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

Figure 6-32. Wide Band Amplifier Fuse Assembly. 3050-M11

RF SWITCH. 3200-M11

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3200	RF Switch			
	PC Board Assy	7001-0152	Cushman	
	PC Board	1780-0281	Cushman	
	CABLE ASSEMBLIES			
	Straight Bulkhead	7032-0010-01	Cushman	
	Straight Bulkhead	7032-0010-02	Cushman	
	Straight Plug	7032-0018-02	Cushman	
	CAPACITORS			
C1	Cer, 220pF, ±10%, 100V	1005-0075	Erie	8101-A100-W5R0-221K
C2	Tant Chip, 6.8μF, ±20%, 20V	1012-0001	Kemet	T411D685M020AU
C3	Feed Thru, 1000pF, +100-0%	1005-0077	Allen-Bradley	FW5N
C4	Feed Thru, 1000pF, +100-0%	1005-0077	Allen-Bradley	FW5N
C5	Feed Thru, 1000pF, +100-0%	1005-0077	Allen-Bradley	FW5N
C6	Cer, 220pF, ±10%, 100V	1005-0075	Erie	8101-A100-W5R0-221K
C7	Tant Chip, 6.8μF, ±20%, 20V	1012-0001	Kemet	T411D685M020AU
C8	Not Used			
C9	Tant Chip, 6.8μF, ±20%, 20V	1012-0001	Kemet	T411D685M020AU
C10	Cer, 220pF, ±10%, 100V	1005-0075	Erie	8101-A100-W5R0-221K
C11	Tant Chip, 6.8μF, ±20%, 20V	1012-0001	Kemet	T411D685M020AU
	COILS			
L1	Choke, Ferrite Bead, U-250	1586-0004	Ferroxcube	56-590-65/4B
L2	Choke, Ferrite Bead, U-250	1586-0004	Ferroxcube	56-590-65/4B
L3	Choke, Ferrite Bead, U-250	1586-0004	Ferroxcube	56-590-65/4B
	DIODES			
CR1	Si, Pin Switching	1281-0050	Motorola	MPN-3401
CR2	Si, Pin Switching	1281-0050	Motorola	MPN-3401
CR3	Si, Pin Switching	1281-0050	Motorola	MPN-3401
CR4	Si, Pin Switching	1281-0050	Motorola	MPN-3401
CR5	Si, Pin Switching	1281-0050	Motorola	MPN-3401
CR6	Si, Pin Switching	1281-0050	Motorola	MPN-3401
CR7	Si, Pin Switching	1281-0050	Motorola	MPN-3401
CR8	Si, Pin Switching	1281-0050	Motorola	MPN-3401
	JACK			
J4	RF Straight, Subminiature	2536-0036	Cushman	
	RESISTORS			
R1	Comp, 1K, ±5%, 1/8W	1065-1025	Allen-Bradley	BB1025
R2	Comp, 680Ω, ±5%, 1/4W	1066-6815	Allen-Bradley	CB6815
R3	Comp, 680Ω, ±5%, 1/4W	1066-6815	Allen-Bradley	CB6815
R4	Comp, 680Ω, ±5%, 1/4W	1066-6815	Allen-Bradley	CB6815
R5	Comp, 1K, ±5%, 1/8W	1065-1025	Allen-Bradley	BB1025
R6	Comp, 1K, ±5%, 1/8W	1065-1025	Allen-Bradley	BB1025
R7	Comp, 1K, ±5%, 1/8W	1065-1025	Allen-Bradley	BB1025





NOTE:

1. RESISTORS - 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN µF UNLESS OTHERWISE NOTED.
3. CHOKES FERRITE BEADS.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.
6. ALL DIODES MPN3401

C8 NOT USED

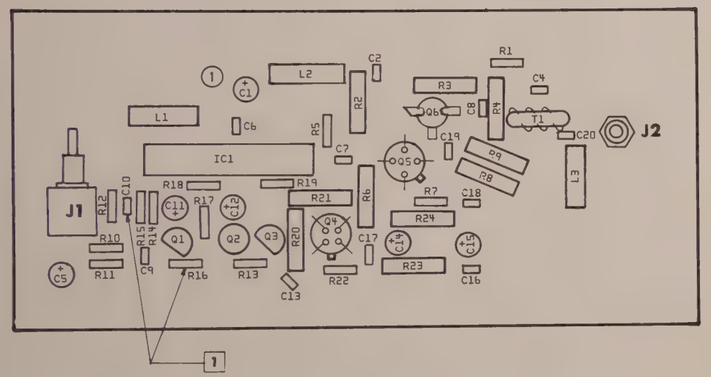
Figure 6-33. RF Switch. 3200-M11

HIGH LEVEL AMPLIFIER. 3300-M11

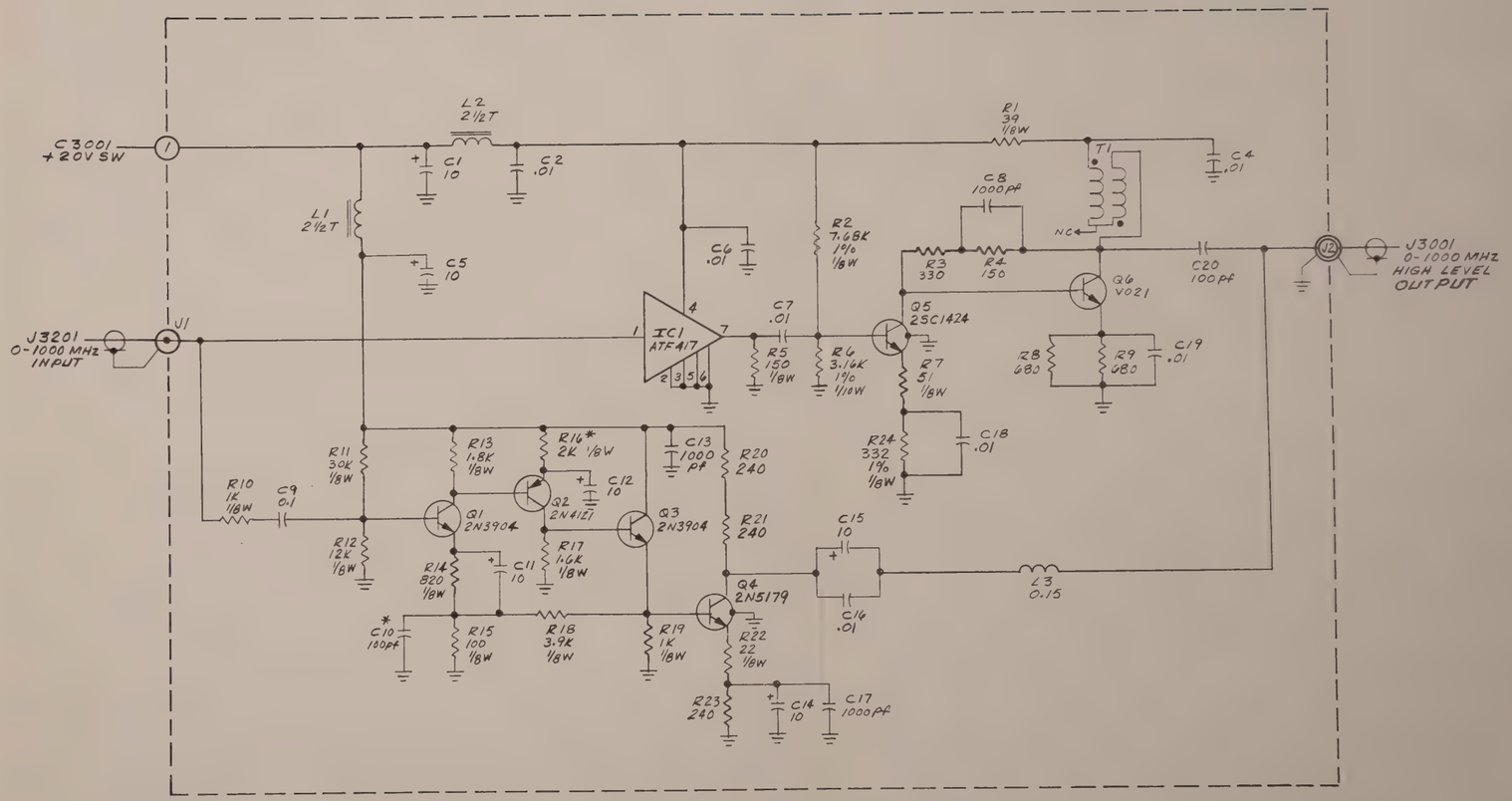
CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
3300	High Level Amplifier			
	PC Board Assembly	7001-0263	Cushman	
	PC Board	1780-0516	Cushman	
	CAPACITORS			
C1	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C2	Cer, .01μF, ±20%, 100V	1005-0100	Erie	8121-100-651-103M
C3	Not Used			
C4	Cer, .01μF, ±20%, 100V	1005-0100	Erie	8121-100-651-103M
C5	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C6	Cer, .01μF, ±20%, 100V	1005-0100	Erie	8121-100-651-103M
C7	Cer, .01μF, ±20%, 100V	1005-0100	Erie	8121-100-651-103M
C8	Cer, 1000pF, ±10%, 100V	1005-0081	Erie	8121-100-W5R-102K
C9	Cer, .1μF, ±20%, 50V	1005-0097	Erie	8121-050-651-104M
C10	Cer, FSV, ±10%, 100V	1005-XXXX	Erie	
C11	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C12	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C13	Cer, 1000pF, ±10%, 100V	1005-0081	Erie	8121-100-W5R-102K
C14	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C15	Tant, 10μF, +50-20%, 35V	1011-0006	ITT	TAG 10/35-20
C16	Cer, .01μF, ±20%, 100V	1005-0100	Erie	8121-100-651-103M
C17	Cer, 1000pF, ±10%, 100V	1005-0081	Erie	8121-100-W5R-102K
C18	Cer, .01μF, ±20%, 100V	1005-0100	Erie	8121-100-651-103M
C19	Cer, .01μF, ±20%, 100V	1005-0100	Erie	8121-100-651-103M
C20	Cer, 100pF, ±10%, 100V	1005-0082	Erie	8121-100-C0G-101K
	CONNECTOR			
J1	Right Angle Jack, 50Ω, Sub Min	2536-0041	Sealectro	50-053-0000
	INDUCTORS			
L1	RFC 2 1/2T, Wide Band	1586-0003	Ferroxcube	VK20020/4B
L2	RFC 2 1/2T, Wide Band	1586-0003	Ferroxcube	VK20020/4B
L3	RFC, .15μH, ±10%	1585-0065	Delevan	1025-00
	INTEGRATED CIRCUIT			
IC1	Wide Band Amp ATF 417	2025-0065	Amperex	ATF417
	RESISTORS			
R1	Comp, 39Ω, ±5%, 1/8W	1065-3905	Allen-Bradley	BB3905
R2	Met. Film, 7.68K, ±1%, 1/8W	1075-0054	Dale	MFF 1/8 T1
R3	Comp, 330Ω, ±5%, 1/4W	1066-3315	Allen-Bradley	CB3315
R4	Comp, 150Ω, ±5%, 1/4W	1066-1515	Allen-Bradley	CB1515
R5	Comp, 150Ω, ±5%, 1/8W	1065-1515	Allen-Bradley	BB1515
R6	Met. Film, 3.16K, ±1%, 1/10W	1074-1016	Dale	RN55D
R7	Comp, 51Ω, ±5%, 1/8W	1065-5105	Allen-Bradley	BB5105
R8	Comp, 680Ω, ±5%, 1/4W	1066-6815	Allen-Bradley	CB6815
R9	Comp, 680Ω, ±5%, 1/4W	1066-6815	Allen-Bradley	CB6815
R10	Comp, 1K, ±5%, 1/8W	1065-1025	Allen-Bradley	BB1025
R11	Comp, 30K, ±5%, 1/8W	1065-3035	Allen-Bradley	BB3035
R12	Comp, 12K, ±5%, 1/8W	1065-1235	Allen-Bradley	BB1235
R13	Comp, 1.8K, ±5%, 1/8W	1065-1825	Allen-Bradley	BB1825
R14	Comp, 820Ω, ±5%, 1/8W	1065-8215	Allen-Bradley	BB8215
R15	Comp, 100Ω, ±5%, 1/8W	1065-1015	Allen-Bradley	BB1015

HIGH LEVEL AMPLIFIER. 3300-M11 (contd)

CKT. REF.	DESCRIPTION	CE STOCK NO.	MFR.	MFR. NO.
R16	Comp, FSV, ±5%, 1/8W	1065-XXXX	Allen-Bradley	BBXXXX
R17	Comp, 1.6K, ±5%, 1/8W	1065-1625	Allen-Bradley	BB1625
R18	Comp, 3.9K, ±5%, 1/8W	1065-3925	Allen-Bradley	BB3925
R19	Comp, 1K, ±5%, 1/8W	1065-1025	Allen-Bradley	BB1025
R20	Comp, 240Ω, ±5%, 1/4W	1066-2415	Allen-Bradley	CB2415
R21	Comp, 240Ω, ±5%, 1/4W	1066-2415	Allen-Bradley	CB2415
R22	Comp, 22Ω, ±5%, 1/8W	1065-2205	Allen-Bradley	BB2205
R23	Comp, 240Ω, ±5%, 1/4W	1066-2415	Allen-Bradley	CB2415
R24	Met. Film, 332Ω, ±1%, 1/8W	1075-0024	Dale	MFF 1/8 T1
	TRANSFORMER			
T1	Toroidal, Bifilar	1579-0035	Cushman	
	TRANSISTORS			
Q1	Si, NPN, 2N3904	1272-0032	Motorola	2N3904
Q2	Si, PNP, 2N4121	1272-0023	Fairchild	2N4121
Q3	Si, NPN, 2N3904	1272-0032	Motorola	2N3904
Q4	Si, NPN, 2N5179	1272-0060	Motorola	2N5179
Q5	Si, NPN, 2SC1424	1272-0071	NEC	2SC1424
Q6	Si, NPN, Microwave V021	1272-0076	NEC	V021



NOTE: 1. FACTORY SELECT.



NOTE:
1. RESISTORS - 1/4W, 5% VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITORS - VALUES IN μF UNLESS OTHERWISE NOTED.
3. INDUCTORS - VALUES IN μH UNLESS OTHERWISE NOTED.
4. *FACTORY SELECT. TYPICAL VALUE SHOWN.
5. ALL VOLTAGES ARE DC UNLESS OTHERWISE NOTED.

C3 NOT USED

Figure 6-34. High Level Amplifier. 3300-M11

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